INDEX

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and
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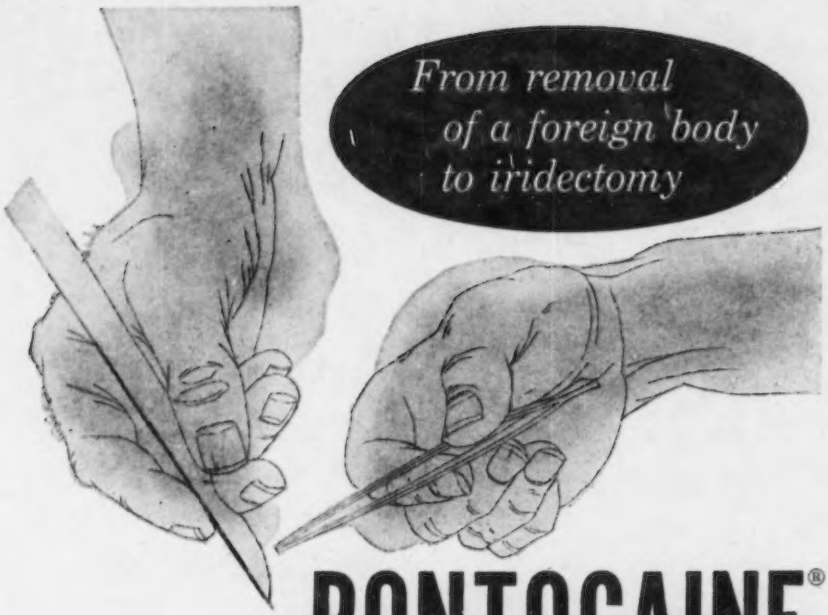
ANNUAL MEETING OCTOBER 11-16, 1953, CHICAGO



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A variety of operative and non-operative procedures on the eye may be successfully carried out with small quantities of 0.5 per cent solution of Pontocaine—

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Shuron

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1/10 12 KARAT GOLD FILLED THROUGHOUT

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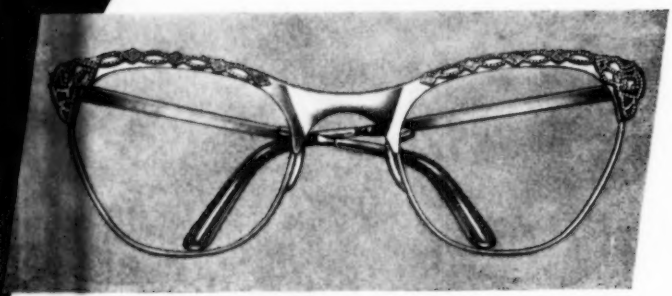
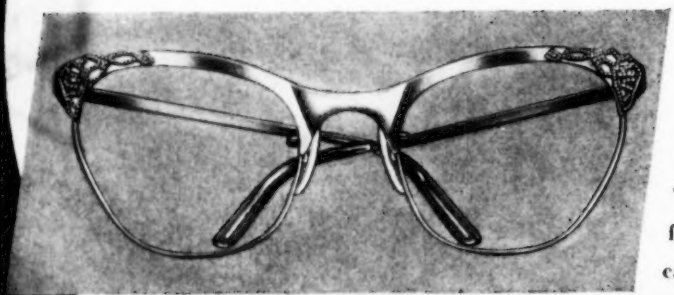


• GOLD LACE HEIRESS



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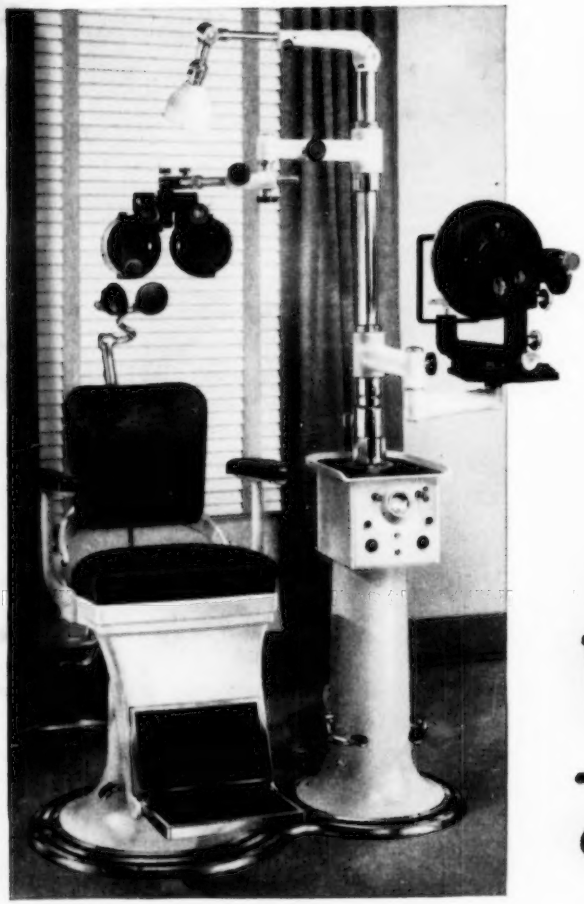

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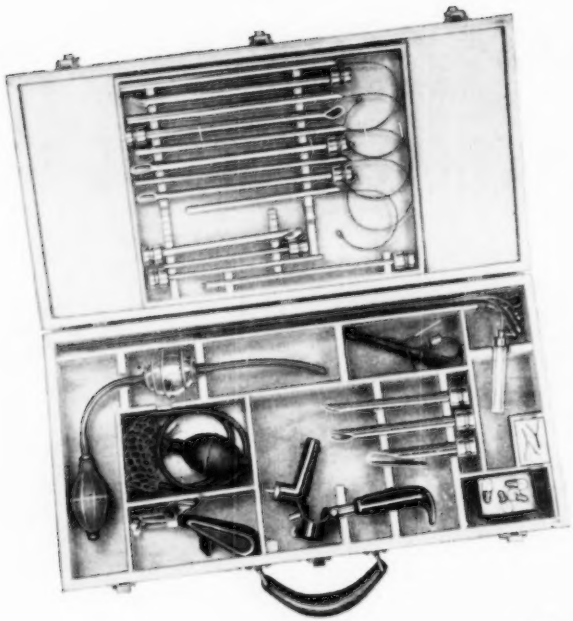

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Combined Tracheo-Broncho-Esophagoscope

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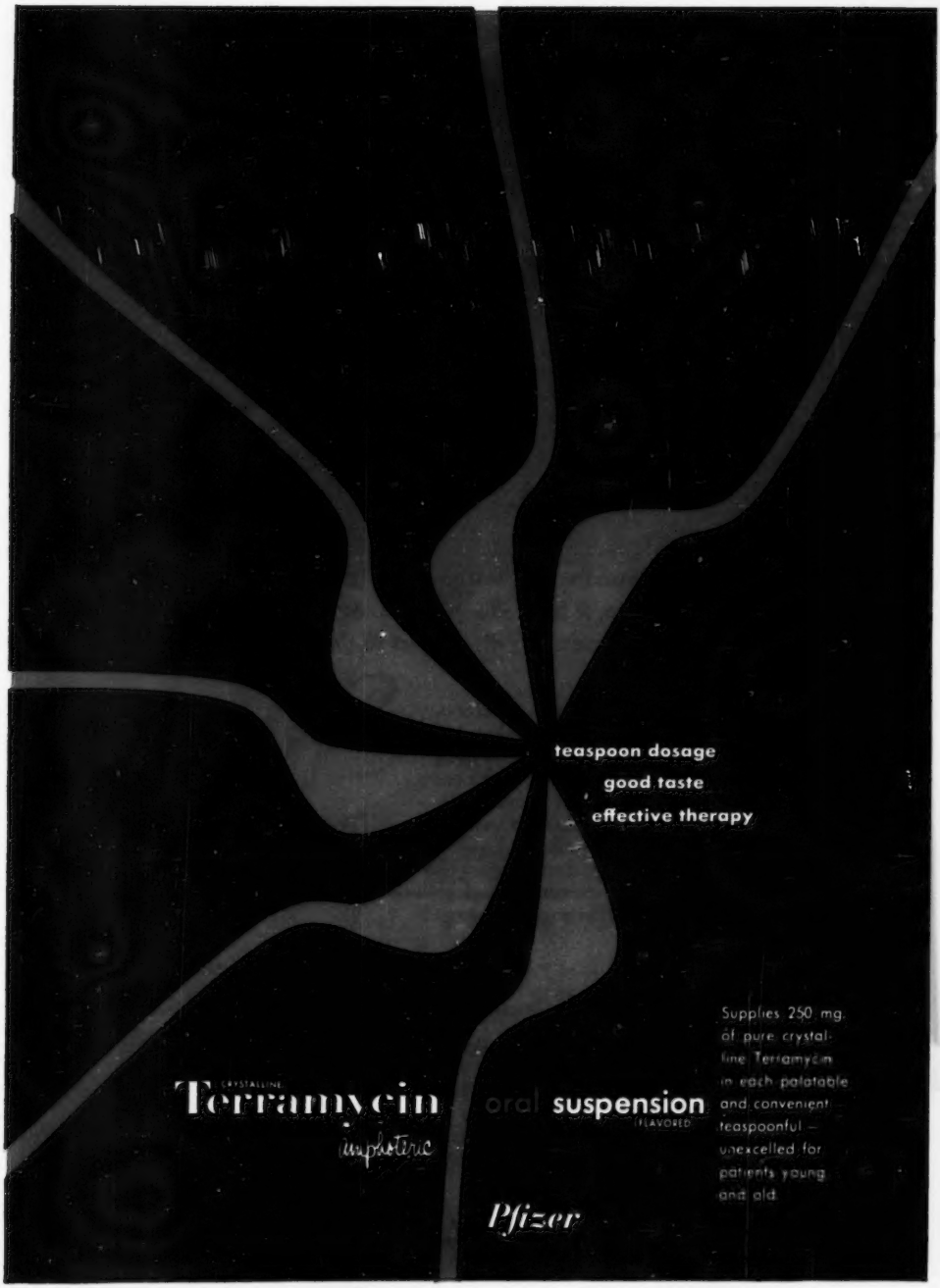

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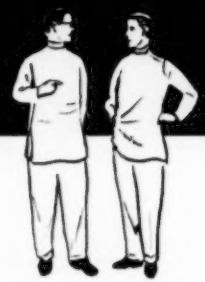
"I am extremely pleased with your product"



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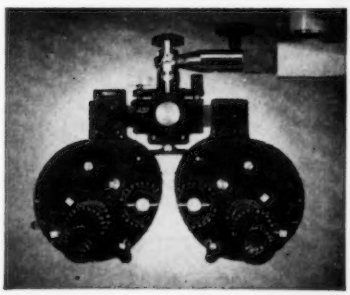

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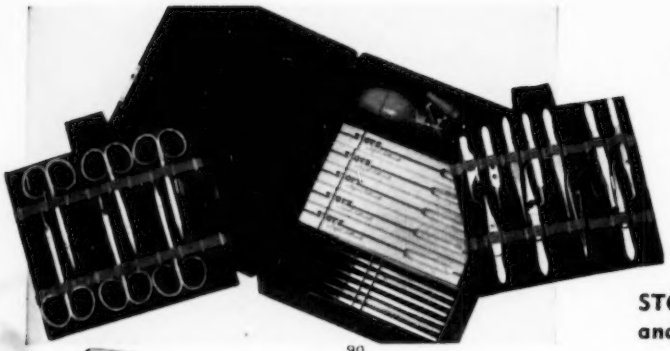

90

92

90 — Small book-size 9½" x 7" x 2½". Large enough to carry instruments for any operation. With Stainless Steel sterilizing rack for 6 knives and two felt covered trays for scissors, forceps, etc. Space to hold 5 individually boxed knives. A long deep compartment to hold eye speculum, needle holder, etc. Durable black leatherette. **$22.50**

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94-95

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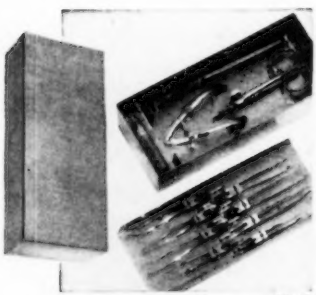

98-B

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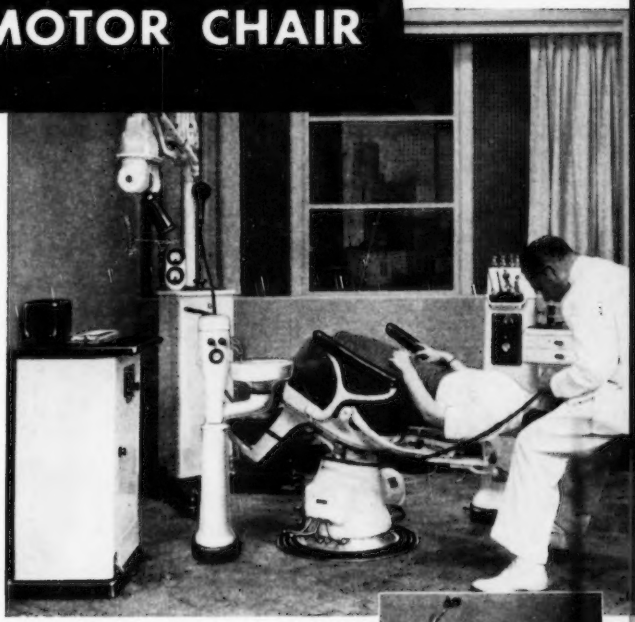
for rapid easy adjustment to any treatment position



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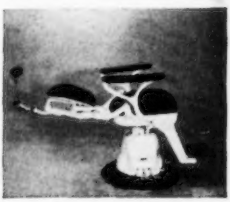
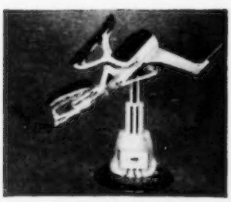


. . . at any desired angle . . .



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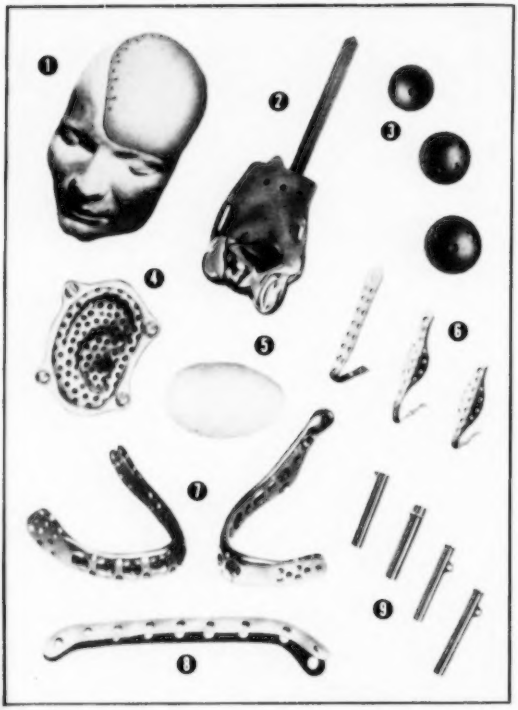

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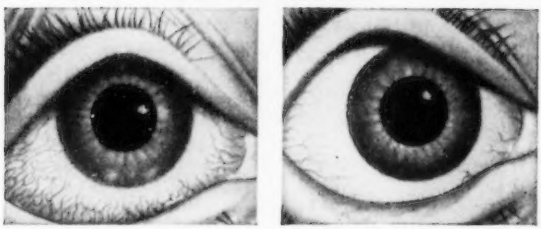

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1. Schele, H. G., Tyner, G. S., Buesseler, J. A., and Alfano, J. E., *J. A. M. A. Arch. Ophth.* 45:301, March 1951.

2. Leopold, I. H., Purnell, J. E., Cannon, E. J., Steinmetz, C. G., and McDonald, P. R., *Am. J. Ophth.* 34:361, March 1951.

Literature on request

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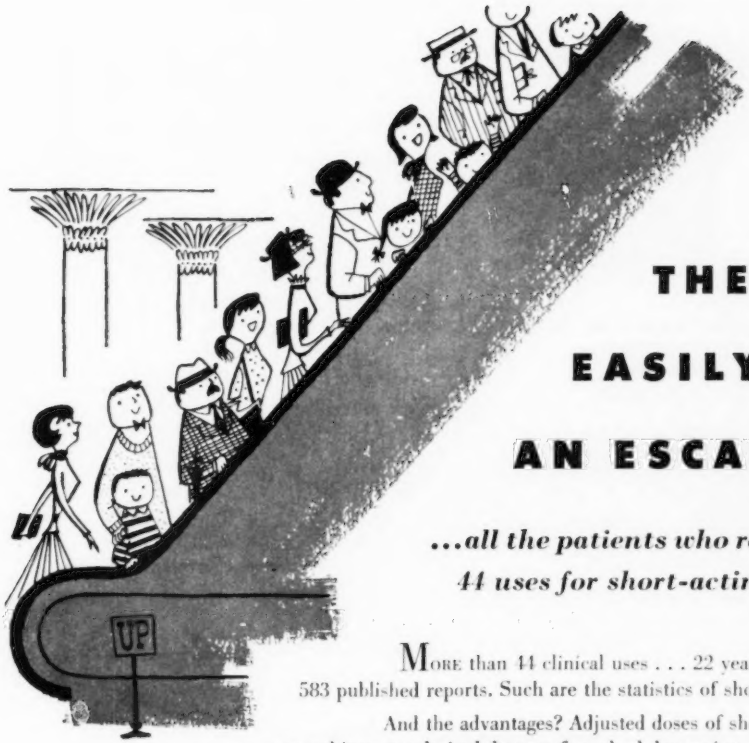

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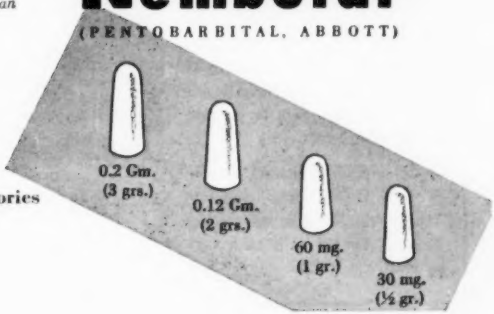

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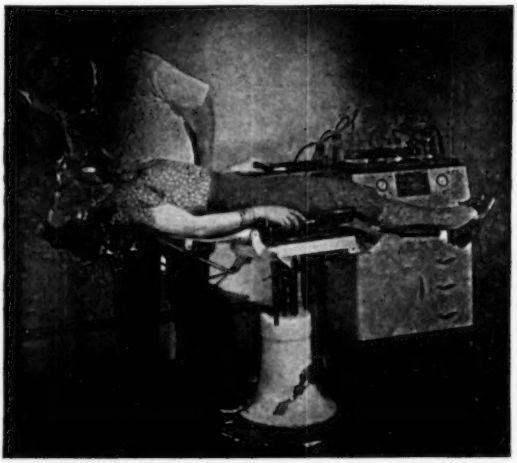

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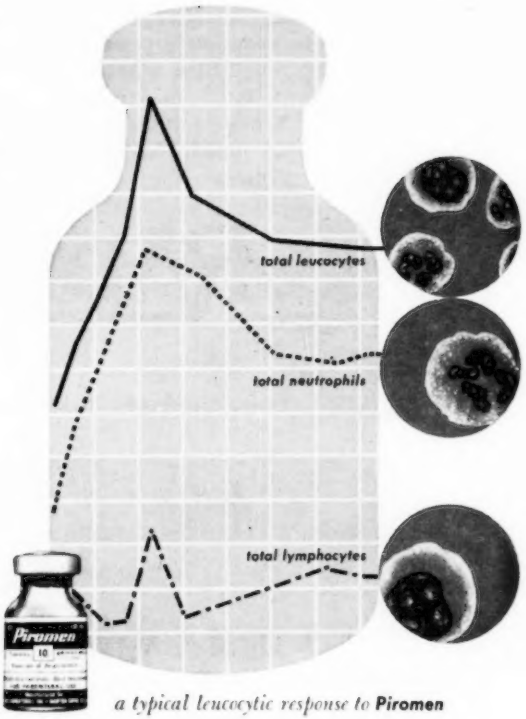

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Jackson Memorial Lecture

A TYPE OF CONGENITAL OCULAR MOTOR APRAXIA PRESENTING JERKY HEAD MOVEMENTS

DAVID G. COGAN, M.D.
BOSTON, MASS.

THE TITLE of this paper has been selected to describe a clinical entity in which there appears to be an inability to turn the eyes voluntarily in a direction for which there is full involuntary or quasivoluntary control and in which a compensatory head movement is so characteristic as to be diagnostic of the entity. So far as I have been able to ascertain this particular entity (congenital ocular motor apraxia) has not previously been described.

The term ocular motor apraxia is used to emphasize the absence of willed movements* but retention of those movements not directly related to the will; it has previously been used in certain cases of acquired loss of willed movements of the eyes.[2,6,7,9] Apraxia has been defined in neurologic vernacular as "The inability to move a certain part of the body in accordance with a proposed purpose, the motility of this part being otherwise preserved."[4] In the type of disturbance to be described in this paper the patient is apparently unable to direct his gaze to one or the other side when his attention is suddenly attracted to that side, although he is able to look freely from side to side when no such stimulus is applied. It is also noteworthy that rotation of the head about the vertical axis results in a maintained contraversive deviation of the eyes which the patient is unable to inhibit.

The compensatory head movements in congenital ocular motor apraxia are often the presenting abnormality and may mask the ocular basis for the disturbance. Being unable to turn the eyes quickly to one side the patient turns his head but in so doing the vestibular reflex causes the eyes to deviate with respect to the head even further to the side opposite the object of attention. Thus to fixate on the object it is necessary to turn the head considerably farther producing the characteristic overshoot. Once the eyes are brought by this means to fixate on the object of attention, the head returns to the position directed toward the object. This whole cycle of jerky or spasmodic head movements on fixation occurs in something less than a second.

This abnormality of eye and head movements has been compared with the normal by means of slow motion moving pictures which may be summarized with the aid of the accompanying diagram (fig. 1). When a person with normal control of eye movements is asked to look at an object to one side he first turns his eyes (usually associated with a blink of the lids) and then his head,

* By willed movements is meant those movements in which a person turns his eye in response to a command or to look at an object that suddenly attracts his attention, or to move his eyes in response to a conscious effort without any apparent external stimuli.

Howe Laboratory of Ophthalmology, Harvard Medical School, Massachusetts Eye and Ear Infirmary, 243 Charles Street, Boston 14, Massachusetts.

Presented at the Fifty-Seventh Annual Session of the American Academy of Ophthalmology and Otolaryngology, Oct. 12-17, 1952, Chicago, Ill.

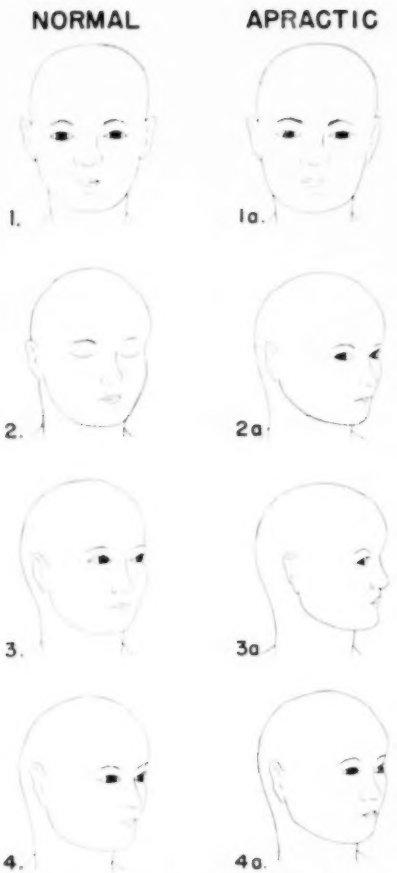

FIG. 1.—Comparison of head-eye movements of a normal person with those of a patient having congenital ocular motor apraxia. The diagrams represent the series of events on looking from the primary position to the left. (The blink of the lids is usually, but not always, present in the normal person and usually, but not always, absent in the apraxic patient.)

but the direction of eye movement is always adversive and the head-turning always lags behind that of the eyes (fig. 2). If gaze is maintained on an eccentric object the head may eventually be turned fully toward the object but never overshoots the mark. In contrast to this, when a person with the type of ocular abnormality under discussion is asked to look at an object to one side he first turns his head and this results in a movement of the eyes in a contraversive direction with consequent overshooting of the mark by the head.

This abnormality has involved lateral movements only and has not been characteristically associated with other ocular or neurologic abnormality. It is apparently of congenital origin but its pathogenesis is obscure.

The present report is based on the study of four cases seen by the author over an eleven-year period. Of these, two were referred to me by a neurologist (Dr. Bronson Crothers) and two by ophthalmologists (Drs. Carl Johnson and Daniel Reagan). This is cited to show that the patients are not necessarily seen first by an ophthalmologist.

CASE REPORTS

Case 1. A.J.S., a boy, was brought to the hospital first at the age of one year because of jerky head movements with simultaneous contraversive deviation of the eyes since birth. The baby was the first and only child. There was no known ocular abnormality in the parents nor relatives.

Delivery was characterized by a prolonged labor, lasting four days, during which time the fetal heart sounds became weak and rapid. The baby was examined by a neurologist one half hour after birth who reported: "definite signs of intracranial damage. The eyes were kept wide open and deviated in a conjugate manner from side to side and at times upward. At the extreme right or left, nystagmoid movements could be appreciated but the greatest part of the movement was rather slow and quite different to true nystagmus." Except for some hyperactivity of the patellar reflexes, the rest of the neurologic examination revealed nothing abnormal. Ten hours after birth and again on the fifth and sixth days the infant had a generalized convulsion.

The patient developed well and, except for the eyes and head movements to be described, appeared normal. It is noteworthy, however, that during the first few months of life persons about him thought he was blind because he did not follow objects with his eyes.

FIG. 2—Photographs of normal head-eye movements on looking from left to right. The child happened to be looking toward the left (a) when she was asked to fixate an object on her right. The lids closed momentarily as the head began to turn to the right (b). When the lids opened, the eyes were seen to be fully turned to the right (c). The turning of the head had lagged behind that of the eyes. Finally, both head and eyes were turned to the right for final fixation (d).

The ocular findings at the age of six months could be analyzed from a home moving picture taken of the baby at that time. They were characterized by a full and free movement of the eyes as the baby looked around in a haphazard fashion. But if his attention were suddenly attracted by an object on the side toward which he was not looking, the eyes appeared to be "frozen" in their previous position and he could fixate the object only by turning his head. This he did very rapidly and while he did so the eyes either remained fixed in the eccentric gaze to the opposite side or turned farther to that side, that is still farther from the object, during the turning (fig. 3). Thus to fixate the object it was necessary to turn the head past the object of attention. Once the object was fixated, however, the head returned to an almost primary position while the eyes continued to be directed toward the object. The whole cycle of events occurred in approximately 1 second.

At the age of one year the ocular phenomena were essentially the same although the parents volunteered that it was less conspicuous than formerly (fig. 4). At this time, however, it could be ascertained that rotation of the head similarly resulted in an eccentric fixation of gaze. Instead of developing a coarse nystagmus on rotation as does the normal infant, the patient's eyes deviated to the side opposite the rotation and remained there during and for 1 or 2 seconds after the rotation. The abnormality in this case was apparently an absence of the rapid phase of that nystagmus which occurs in the normal one-year-old infant on rotation. The rest of the neurologic and psychometric examination indi-

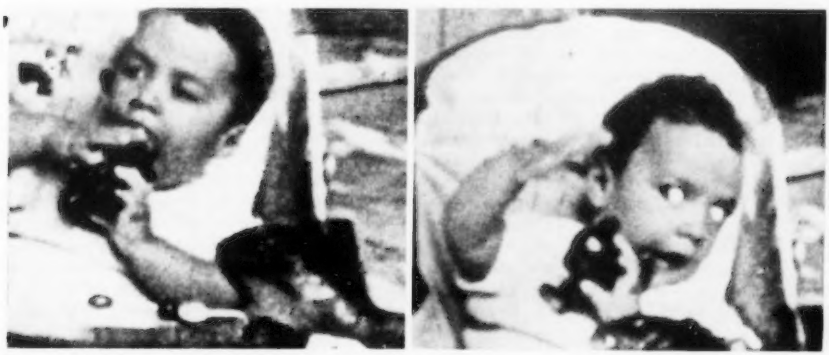

FIG. 3—Photographs of first patient (case 1).

The pictures were taken at the age of 6 months. The patient was gazing to the right when a toy fish was brought in from the left attracting his attention. Being unable to turn his eyes to the left, the baby turned his head and in so doing developed a further dextroversion of his eyes (in respect to his head).

FIG. 4.—These pictures were taken at the age of 1 year. The patient was looking at a pocketbook to his right (a) when the noise of the moving picture camera in front of him attracted his attention. In order to fixate straight ahead, he thrust his head to the left (b) with extreme dextroversion of his eyes. Fixation with the eyes necessitated overshoot of the head (c). Once that fixation was attained, the head turned back to approximately the primary position (d). The same sequence of events occurred on looking to the right. Thus, the patient happened to be gazing to the left (e) when the noise of the camera attracted his attention. He looked to the right by overshoot of the head to the right (f) and relative levoversion of the eyes until fixation was attained. Then the head returned to approximately the primary position (g).

cated an otherwise normal infant. The ability to fixate on small objects indicated a good visual acuity.

The patient was again examined at the age of 9½ years. The chief complaint in the meantime had been in reading. He volunteered that he was unable to scan a line, in fact could not read more than one word at a time. His mother also observed that he stumbled more than most children and especially when he was with strangers. The patient further stated that he had difficulty in making sharp turns, specially in quarters with which he was unfamiliar, and was thereby incapacitated for horseback riding. No change in the eye status had been observed by the patient or parents even though he had been given extensive exercises on "learning to control the eyes" by looking in a mirror while rotating the body. Of particular interest was the parents' observation that the patient appeared to develop a spasm of gaze when commanded to look in one or the other direction and that this was also more apparent in the presence of strangers. As a consequence the family had purposely avoided the command "look."

Neurologic examination at the age of 9½ years showed no abnormality other than that associated with the eyes. Mental development was said to be normal for his age. The abnormalities in the eyes were essentially the same as those previously noted consisting of a defect in voluntary horizontal gaze and in the presence of a compulsory labyrinthogenic deviation of the eyes (fig. 5). When the examiner faced the patient and snapped his fingers to either side the patient was unable to make quick movements of regard without turning his head. Indeed he often appeared to move the eyes in the wrong direction. He was unable to follow a finger moved slowly to either side. Yet when the patient was not commanded to look in any direction the eyes moved freely and fully. If the patient's head was not restrained actively or passively and he was commanded to look to one side or the other he would show the same overshooting of the head with contraversive deviation of his eyes as he had shown in infancy. With the opticokinetic drum there was only an abortive response consisting of a single deviation of the eyes in the direction of rotation of

FIG. 5.—The final picture of the patient in figure 4 was taken at the age of 9½ years. The eyes showed extreme levoversion on rotation of the body to the right. Similarly an extreme dextroversion of the eyes occurred on rotation of the body to the left.

the drum; there was thus an absence of the fast phase of the opticokinetic cycle. Vertical movements on command and on following a moved object were entirely normal and the opticokinetic response in the vertical direction was prompt and well sustained.

There was no spontaneous nystagmus. The pupils were of normal size and reaction. The fundi were normal.

Case 2. M.S., a boy, was first seen at the Eye Clinic of the Massachusetts Eye and Ear Infirmary at the age of 11 months because of "muscle trouble" of the eyes. Since the age of 3 months the patient had been noted to turn his head instead of his eyes when fixating an object to one side.

The patient had been delivered by forceps but no other unusual event had occurred at birth or subsequently. Aside from the eye and head movements, the patient was considered normal. The mother did think that learning to walk was unusually delayed and that the patient was unduly awkward. There was, however, no evident neurologic abnormality.

Examination of the eyes showed an inability to look to either side when the patient's attention was suddenly alerted but full random movements when "at ease." To fixate on an object to either side the patient made a quick turn of the head past the object of ragard. This was accompanied by a deviation of the eyes to the side opposite the direction of head movement until fixation was attained. The entire cycle occurred in a fraction of a second and gave the effect of a curious throwing of the head to either side. It was approximately symmetrical. The opticokinetic test elicited a slow phase but no rapid phase in the horizontal direction. On rotation of the patient about the vertical axis the eyes regularly assumed a conjugate and extreme deviation in the direction opposite to that of rotation.

Movements of the eyes in the vertical direction appeared to be normal and the opticokinetic response in the vertical direction was normal.

The patient was again examined briefly at the age of 2½ years. The characteristic thrust of the head to either side on eccentric fixation persisted. Rotation of the body also resulted in uncontrollable deviation of the eyes to the side opposite the direction of rotation. The opticokinetic response was definitely abnormal to either side but abortive cycles were obtained on rotation of the drum to the patient's left. The patient appeared to be able to follow a slowly moving finger fairly accurately although his age made accurate testing unreliable.

The patient was not subsequently examined but correspondence with his physician indicated that at the age of 7 there was still compulsory deviation of the eyes on rotation and some overshoot of the eyes on eccentric fixation.

Case 3. P.I., physician's son who was first examined at the age of 3½ years. There had been no unusual events during gestation or delivery and the patient had appeared normal during the first few months of life except for a web toe between the second and third digits. An abnormality of the eyes was first suspected at 3 months of age when the patient did not respond as a normal infant would to objects brought into his field of vision. Accordingly he was thought to be blind. However, at the age of 5 to 6 months he began to fixate on objects by the jerk of his head which continued to the time of the first examination without substantial change. The abnormal head movements were said to be more conspicuous when the patient was fatigued. Except for this abnormality of head and eye movements the child had developed normally.

On examination the eyes were usually held in the primary position and so long as the patient was not being alerted to look to either side he had full random movements. But when he was asked to fixate an object on either side without moving his head he usually "froze up" and was unable to turn the eyes in the desired direction. Left to his own de-

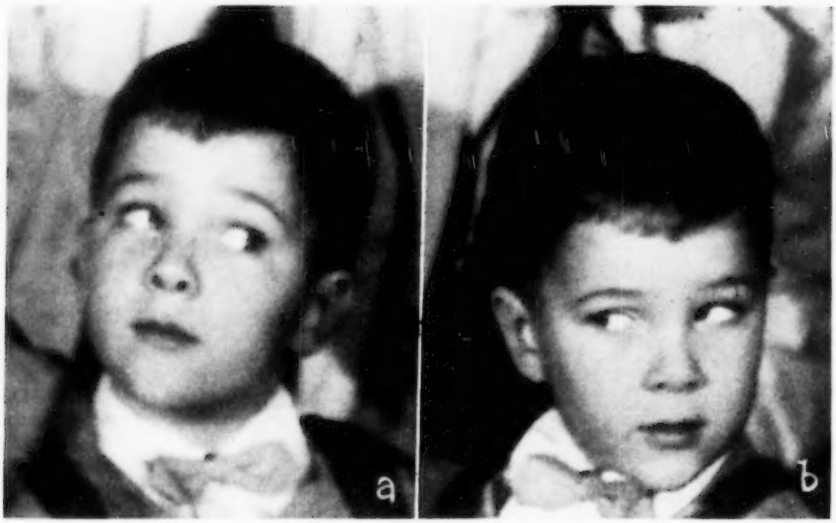

FIG. 6.—Photographs of the third patient (case 3).

These two pictures were taken at the age of 3½ years. The first picture shows levoversion of the eyes on rotation of the body to the right and the second picture shows dextroversion of the eyes on rotation of the body to the left.

vices, he would fixate an object by thrusting his head toward the object of attention. This was characteristically accompanied by a contraversive deviation of the eyes necessitating an overshoot of the head movement for fixation. The opticokinetic response could not be elicited with horizontal rotation of the visual field. Rotation of the body to either side resulted in a contraversive deviation of the eyes (fig. 6).

The vertical movements of the eyes appeared to be promptly and normally performed and there was a well-sustained vertical opticokinetic response.

The patient was again examined at 5 and 6 years of age. He had developed normally except for the eyes and was able to ride a tricycle and participate actively in the usual athletic activities of childhood. The essential abnormality of absence of willed movements remained unchanged, although the full random movements were present. The patient continued to show the characteristic head movement on looking to either side (fig. 7) and the mother observed that this was most striking when he was fatigued or excited. Rotation of the body resulted in a contraversive and maintained deviation of the eyes which the patient was unable to inhibit. The opticokinetic test showed a slow phase but an absence of the fast phase of the cycle. Following movements of the eyes were jerky and poorly executed. The vertical movements were normal for command, following, and opticokinetic tests.

Case 4. E.O., 2-year-old male infant who was admitted to the hospital for spasticity of gait and anomalous eye movements thought to date from birth.

The patient's mother had had carbon monoxide poisoning in the second month of pregnancy and was comatose for 12 hours. She recovered, however, without manifest sequelae. Pregnancy and delivery had been otherwise uneventful. Two siblings, both older than the patient, were normal.

Until the baby began to walk, development was thought to be normal. He sat alone at 8 months of age and stood alone at 18 months. At 23 months he began to take steps but it was noted that he had an extremely awkward gait, characterized by stiffness of the legs and instability of posture.

Neurologic examination at 2 years of age showed a marked rigidity of all extremities, but greater on the right, that was thought to indicate an extrapyramidal syndrome. However, there was no clonus or extensor plantar reflex. Examination at the age of 3 years and again at 3½ years of age is said to have shown a mild right hemiplegia and tight heel

FIG. 7—These pictures were taken at the age of 6 years. The patient was gazing to the right (a) when he was asked to look at the camera. A turn of the head was accompanied by a closure of the lids, as in the normal person, but when the lids opened the eyes were seen to be in the position of extreme dextroversion (b). As a result the patient had to overshoot the mark with his head to attain fixation straight ahead (c). Once the eyes fixated, the head returned to the approximately primary position (d).

cords characteristic of a patient with cerebral palsy. He was thought to be mentally normal for his age.

Examination of the eyes at 2 years of age revealed an inability to turn the eyes when attention was suddenly alerted to an object in the eccentric field but preservation of full random movements. To fixate an object the patient thrust his head to one side (fig. 8). This was accompanied by an involuntary contraversive deviation of the eyes with consequent overshoot of the head on fixation. Similarly with rotation of the body about a vertical axis an involuntary deviation of the eyes regularly occurred in the direction opposite to that of rotation of the body. The inability to look to either side was present bilaterally but the head thrust appeared to be more striking in fixating objects on the left than on the right. The opticokinetic test elicited a slow deviation of the eyes in the direction of rotation of the drum but no nystagmus. Following movements appeared to be normal although co-operation was necessarily limited in a 2-year-old infant.

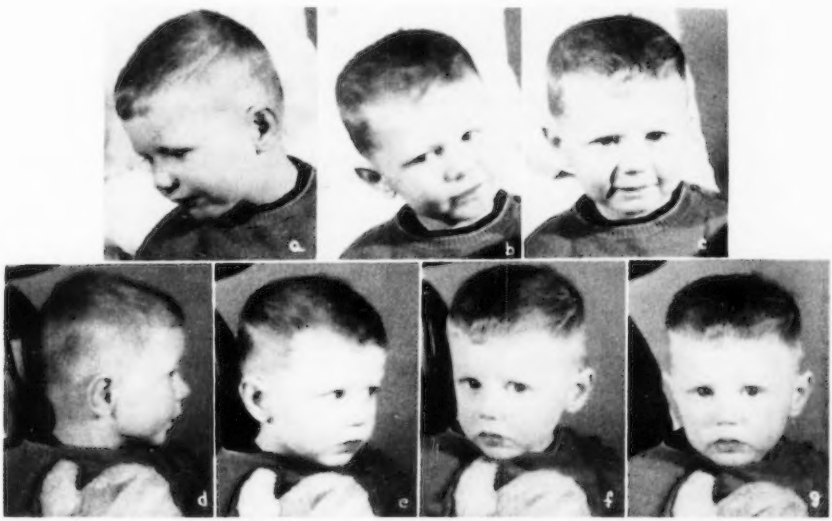

FIG. 8—Photographs of the fourth patient (case 4) taken at 3½ years of age. The patient happened to be gazing to the right and down (a) when he was alerted by an object directly in front of him. He responded by turning his head to the left (b) and overshooting the mark. After attaining fixation the head returned to the approximately primary position (c). Conversely, when the patient happened to be gazing to the left (d) and his attention was directed to an object straight ahead, he responded by turning his head to the right (e) with consequent levoversion of his eyes. The head then overshot the mark (f), but after fixation, returned to the primary position (g).

Vertical movements appeared normal for both following and command movements. In contrast to the compulsory deviation of the eyes without nystagmus in the horizontal meridian, a well-sustained vertical and rotary nystagmus without maintained deviation of the eyes was produced by rotation of the head about appropriate axes.

The patient was re-examined at 2½ and 3½ years of age. He continued to have considerable ataxia in walking, had frequent falls, and was unable to cope with a tricycle. The eyes showed the same inability to look voluntarily to either side with consequent head thrusts. Rotation of the body resulted in contraversive deviation of the eyes which could not be inhibited. Visual acuity was normal and the rest of the ocular examination did not reveal any abnormality.

The presented cases of ocular motor apraxia must be distinguished from other disturbances listed under the broad category of pseudo-ophthalmoplegia. They must especially be distinguished from those conditions in which voluntary control of eye movements is lost but in which vestibulogenic deviation of the eyes is retained (the so-called Roth-Bielschowsky syndrome).[1,5] In this syndrome the vertical movements are preferentially or exclusively affected and there are usually other neurologic signs and symptoms collectively termed pseudobulbar palsy. Indeed it was the analogy with the clinical entity of pseudobulbar palsy that led to the designation of the eye signs as pseudo-ophthalmoplegia.[8] A particularly graphic illustration is to be found in the case report of Ford and Walsh.[3]

In common with this type of pseudo-ophthalmoplegia, the present patients with ocular motor apraxia had paralysis of voluntary movements and showed reflex deviation of the eyes with labyrinthine stimulation. But they differ from pseudo-ophthalmoplegia in the preservation of random movements (indeed the harder the patient with apraxia tries, the less well can he execute the desired act; this is just the reverse of the case with pseudo-ophthalmoplegia) and in the preferential involvement of lateral movements.

The few cases of acquired ocular motor apraxia that have been described and the congenital cases herein described have in common the essential abnormality of loss of willed movements of the eyes with retention of random movements but the curious jerky head movements which are so characteristic of the congenital type were absent in the acquired form. This absence of compensatory head movements in the acquired form was due, in at least one case seen by the author, to the fact that there was apraxia of the head movements as well as of the eye movements so that compensatory head movements could not be executed. The congenital variety, on the other hand, was a selective involvement of the ocular motor mechanism with retention of full control of the head movements. A further difference may be present in that the compulsory vestibulogenic deviation of the eyes which is present with the congenital type may not be present with the acquired type. However, data on the vestibular activity of the acquired variety is too meager to be conclusive.

It is curious that congenital ocular motor apraxia has not been described in adults and that the present author should have seen it in four infants and not once in an adult. The possible explanation that it clears up in later life seems unlikely in so far as there has not been any major change in the one patient who has been followed longest, that is from 6 months to 9½ years of age. All the patients in the present group were boys but whether or not this is of significance must await a larger series. No evidence was obtained that it is familial and only in one patient was it accompanied by other neurologic deficits. Whether the condition represents the development of an abnormal neurologic state or is the abnormal persistence of a normal de-

velopmental stage is a perennial question in all congenital defects. However, it does seem that an apraxia of the eye movements is a normal condition for infants during the first few weeks of life. When newborn infants are alerted by an object to one side they show little ability to fixate the object; yet the retraction of their lids is sufficient evidence of their state of alertness and they have full random movements of their eyes. It is, moreover, well known that they show also the maintained deviation of the eyes on rotation of the head.

Congenital ocular motor apraxia can scarcely be said to be incapacitating. Patients with it apparently learn to walk with only slightly more difficulty than normal and usually participate in the usual athletic activities of childhood with little difficulty. The curious thrusts of the head are, however, alarming to the parents and disconcerting to the physician unless he understands the basis for them. It is noteworthy that two of the present patients were first thought to be blind because of their failure to fixate on objects. The only patient in the present series to have reached sufficient maturity to make worthwhile introspective observations stated his only real handicap was in reading and in making quick turns.

A reasonable direction of therapy might be aimed at depression or abolition of the labyrinthine function but the symptoms so far have not warranted the hazards involved.

SUMMARY AND CONCLUSIONS

1. A clinical syndrome is described in which there is an absence of willed movements of the eyes to either side, although full random movements are retained, and in which fixation of gaze is accomplished by a jerky overshooting of the head. Rotation of the head about the vertical axis results in an involuntary and maintained deviation of the eyes in the direction opposite to that of rotation. It is this contraversive deviation of the eyes which the patient is unable to inhibit that conditions the characteristic overshooting of the head on fixation of an eccentric point. The abnormality is one of horizontal movements only and involves movements resulting from command, following, and opticokinetic stimuli.

2. The syndrome is represented in the present report by four patients. It was presumably congenital in all. In two patients there was nothing else in the history or examination to suggest other neurologic disease; in one patient there were convulsions shortly after birth but no neurologic sequelae; in the fourth patient there was a history of carbon monoxide asphyxia in the mother during the second month of gestation and the child had a persistent extrapyramidal disease. No other members of the family had similar or related disease in any of the cases.

3. The syndrome must be differentiated from (a) simple palsies of conjugate gaze in which random movements are lost to as great or greater extent than are the willed movements and from (b) other forms of congenital pseudoophthalmoplegia in which vertical movements are predominantly affected and in which there are other neurologic symptoms.

4. Although the entity of acquired apraxia has been previously described, this appears to be the first description of the congenital variety. Unlike acquired ocular motor apraxia, in which head and eye movements are both involved, the congenital variety involves eye movements exclusively, and fixation on an eccentric point is accomplished by characteristic head jerks.

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THE DIFFRACTION LENS

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AFTER months of working with a squinting child, during which time the proper refractive correction has been worn, the visual acuity of an amblyopic eye has been reclaimed by patching, indicated surgical intervention has been accomplished and orthoptic aid has been given, how discouraging it is to realize that the child is still monocular and is still suppressing the affected eye. We all have had this experience. In these children we have only been able to establish the physical potential of binocular vision and we have failed in advancing their visual development to the mature stage of binocular fusion. Here is a need. With this problem in mind, I have reasoned that by reducing the visual acuity in the preferred eye one or two Snellen-test lines below that of the reclaimed one, a situation would be induced which would be an incentive for the constant use of both eyes. If the acuity were reduced enough to offer a relatively clearer image in the previously amblyopic eye than in the good one, this should tend to stimulate the use of the suppressing eye since it now yields the better detailed vision. At the same time the preferred eye would retain a sufficiently well-defined image that could not be ignored; thus tending to create simultaneous perception and the recognition of double images, and encouraging fusion of those images.

I am presenting a lens which I feel will furnish the necessary alteration in visual acuity without introducing any deleterious secondary effects. It diminishes the resolving power of the eye so that acuity may be reduced from 20/20 to 20/25, 20/30 or 20/40, as indicated, without interfering with the normal function of the eye. It is obtained by processing the regular prescription lens. I have been using a reduction in vision equal to or slightly below that of the well-established acuity in the reclaimed eye. The lens is easily tolerated by children and is inconspicuous to wear. Clinically the results have been encouraging and I am planning to continue using these lenses in hope of confirming their utility and defining their limits of application. I have a source for the lens preparation and would welcome the cooperation of any one wishing to subject it to clinical trial in his practice.

Presented as a *New Method* at the Fifty-Sixth Annual Session of the American Academy of Ophthalmology and Otolaryngology, Oct. 14-19, 1951, Chicago, Ill.

OCULAR TOXOPLASMOSIS

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ACUTE or healed chorioretinal lesions are an important feature in the diagnosis of congenital toxoplasmosis. This knowledge has caused numerous investigations on the relationship of toxoplasmosis to juvenile and adult uveitis. The identification of organisms resembling Toxoplasma in chorioretinal lesions in 53 eyes by Wilder[8] furnished almost conclusive histologic evidence that this organism is an important cause of adult uveitis.

To prove that an individual clinical case of uveitis is due to Toxoplasma, however, is another matter. The ocular lesion usually occurs as an isolated phenomenon and there are no generalized symptoms which might suggest toxoplasmosis. The ocular lesion may not cause sufficient stimulation of the general antibody response; therefore, serologic studies may be inconclusive. Finally, a certain proportion of the normal population possesses serum antibodies for toxoplasmosis in a low titer, especially after the age of 20.

These facts make it necessary that detailed studies for evidence of toxoplasmosis be made on patients with uveitis. Serologic tests for the diagnosis have been devised and refined during the past four years so that methods are available by which it may be possible to establish the diagnosis in a percentage of patients. The methylene blue dye test of Sabin and Feldman and the complement-fixation test are considered the most accurate and dependable. It has been demonstrated that dye test antibodies appear early in the disease (second to fourth week) and persist in fairly high titer for considerable periods (four to six years). We consider this test to be the most dependable for routine studies.

A sufficient number of cases of acute acquired toxoplasmosis have been recorded to provide information on the clinical picture. Sabin[6] described two children with an acute encephalitis. One of these patients survived. Parasites were recovered from mice inoculated with brain emulsion from the patient which died, and Toxoplasma-like structures were found in a few areas of the child's brain. Two guinea pigs died after inoculation with cerebrospinal fluid from the surviving child and Toxoplasmas were found in their tissues. Pinkerton and Henderson[4] reported two patients who developed an acute febrile illness with pulmonary symptoms and a fine maculopapular rash. Both patients died. In the first patient parasites morphologically resembling Toxoplasma were found. Guinea pigs inoculated with tissues from these patients died of toxoplasmosis. Other cases of a similar type have been reported.[2,3,5,7]

A number of acute infections have been recorded in laboratory workers handling Toxoplasma. In most of these patients the disease was characterized by fever, malaise, lymphadenopathy and a maculopapular eruption. High anti-

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body titers were found in the sera of these patients. Ocular lesions have not been observed in any of these reported cases.

It is not known how humans acquire toxoplasmosis. It is known that a chronic latent form of the disease exists, and that a pregnant woman may infect the fetus without exhibiting signs of the disease. The method by which the eye becomes affected in the acquired form of the disease is also obscure.

The present report includes the results of a survey of 338 cases of uveitis for evidence of toxoplasmosis, utilizing the methylene blue dye test and skin test. During the early portion of the study we were interested in gathering information with regard to the incidence of positive tests in various age groups. During the past year we have attempted to establish the diagnosis in individual cases by serial testing of the serum in appropriate cases. Additional information is being gathered at present by use of both the methylene blue dye test and the complement-fixation test. It is expected that sufficient numbers of early cases of uveitis may be obtained to provide information on the changes in the serum antibodies in patients with possible ocular toxoplasmosis.

The final proof of the diagnosis of systemic or ocular toxoplasmosis depends upon isolation of parasites from body fluids and tissues. With respect to the eye this conclusive proof may be extremely difficult, if not impossible, except from enucleated eyes, and most diagnoses may have to be considered as "probable" on the basis of the serologic findings.

RESULTS

The 338 cases forming the basis of this report had complete uveitis surveys, including a physical examination. Special studies were done when indicated. In approximately 5 per cent of the cases a positive diagnosis (Boeck's sarcoidosis, syphilis, sympathetic ophthalmia, Harada-Vogt-Koyanagi syndrome, etc.) could be made. In an additional 15 per cent a probable diagnosis (tuberculosis, congenital toxoplasmosis, focal infection, associated infectious disease, etc.) could be made. All these cases are included in this study. The cases are presented according to age groups, and according to the site of the disease (tables I-VII).

IN UVEITIS PATIENTS

TABLE I

AGE 0 - 9

Diagnosis	No. Cases	Skin Test Pos.	Skin Test Neg.	Dye Test 1:8	Dye Test 1:64	Dye Test 1:128	Dye Test Neg.
Chorio-retinitis	10	0	10	1	1 (mother 1:256)	1	7
Irido-cyclitis	2	0	2	0	0	0	2
Total	12	0	12	1	1	1	9

TABLE II

AGE 10 - 19

Diagnosis	No. Cases	Skin Test Pos.	Skin Test Neg.	Dye Test 1:16	1:32	1:64	1:128	Neg.
Chorio-retinitis	13	3	10	2	1	3	3	4
Irido-cyclitis	11	0	11	1		1		9
Diffuse uveitis	1	0	1		1			
Total	25	3	22	3	2	4	3	13

TABLE III

AGE 20 - 29

Diagnosis	No. Cases	Skin Test Pos.	Skin Test Neg.	Dye Test 1:8	1:16	1:32	1:64	1:128	1:256	Neg.
Chorio-retinitis	42	11	31	5	7	4	3	2	1	20
Irido-cyclitis	30	5	25	3	1	2	1	1	1	21
Diffuse uveitis	2	0	2				1			1
Total	74	16	58	8	8	6	5	3	2	42

TABLE IV

AGE 30 - 39

Diagnosis	No. Cases	Skin Test Pos.	Skin Test Neg.	Dye Test 1:8	1:16	1:32	1:128	1:256	1:512	Neg.
Chorio-retinitis	28	6	22	4	6	5	3	1		9
Irido-cyclitis	53	2	51	2	6	4			1	40
Diffuse uveitis	2	0	2	1						1
Total	83	8	75	7	12	9	3	1	1	50

TABLE V

AGE 40 - 49

Diagnosis	No. Cases	Skin Test Pos.	Skin Test Neg.	Dye Test 1:8	1:16	1:32	1:64	1:128	1:256	Neg.
Chorio-retinitis	24	6	18	4	5	1	4			10
Irido-cyclitis	40	4	36	2	6	2	2	1	1	26
Diffuse uveitis	5	0	5							5
Total	69	10	59	6	11	3	6	1	1	41

TABLE VI

AGE 50 - 59

Diagnosis	No. Cases	Skin Test Pos.	Skin Test Neg.	Dye Test 1:8	1:16	1:32	1:64	1:128	1:256	Neg.
Chorio-retinitis	7	1	6	1	1					5
Irido-cyclitis	29	3	26	1	2	3		1	1	21
Diffuse uveitis	1	0	1							1
Total	37	4	33	2	3	3		1	1	27

TABLE VII

AGE 60 AND OVER

Diagnosis	No. Cases	Skin Test Pos.	Skin Test Neg.	Dye Test 1:8	1:16	1:32	1:256	Neg.
Chorio-retinitis	1		1					1
Irido-cyclitis	36	4	32	5	4	1	1	25
Diffuse uveitis	1		1					1
Total	38	4	34	5	4	1	1	27

Among these cases were several which were seen sufficiently early and had lesions suggestive of a toxoplasmic chorioretinitis. Serologic studies were carried out serially for evidence of a changing titer.

CASE REPORTS

Case 1. M.O., nurse, age 34.

The patient had normal vision in each eye until the age of 24, when a bilateral macular chorioretinitis developed. The acute phase of the disease lasted two weeks, followed by slow subsidence of the inflammation. Final vision in the right eye was 20/20, and in the left eye 20/200.

A recurrence developed in the right eye during July 1951, at the age of 34. Vision in the right eye was 20/100, and in the left 20/200. The right eye showed a mild ciliary injection. There were scars in the macular areas of both eyes. The one on the right lay adjacent to the fovea. A large elevated yellowish white acute focus of chorioretinitis involved the nasal portion of the right eye. There were numerous vitreous opacities. There was no active lesion in the left fundus. The patient was in excellent physical health.

A complete survey revealed no active cause for the ocular disease. The toxoplasmin skin test was positive. With the methylene blue dye test serologic studies showed the following:

Aug. 1, 1951	1:32
Aug. 8, 1951	1:256
Aug. 17, 1951	1:512 (repeat 1:1024)
Oct. 2, 1951	1:64
Nov. 30, 1951	1:16
June 4, 1952	1:32

The patient's mother had a titer of 1:64, her brother 1:16, and another sister had no antibodies.

The patient was treated with oral cortisone for 17 days and the inflammation subsided rapidly, without a recurrence after cessation of treatment.

Comment. We believe the ocular inflammation in this case was due to Toxoplasma. The site and character of the lesion and the rise in titer to a fairly high level provide fairly conclusive evidence as to the diagnosis.

Case 2. G.M., housewife, age 46.

The patient had an acute attack of chorioretinitis in the left eye at the age of 31. Vision was blurred for three months, following which it gradually cleared.

A mild attack of chorioretinitis occurred in the same eye in April 1952, and recurred several times during May 1952. We first observed her in July 1952 at which time the inflammation had become more severe. Vision was 20/20 in the right eye and 20/200 in the left. Examination showed an acute area of chorioretinitis in the left eye along the upper temporal artery above the macula. There was considerable macular edema, with numerous intraretinal and subretinal exudates. There was a large area of old healed chorioretinitis below and temporal to the macula, and another area of smaller size inferior to the macula.

A complete physical examination and uveitis survey failed to reveal a cause for the uveitis. The toxoplasmin skin test was negative (0.5 mm. induration and 15 mm. erythema in 48 hours). The methylene blue dye test showed the following:

July 2, 1952	1:16
July 15, 1952	1:28
Aug. 8, 1952	1:512+

The patient is under observation and additional sera are being examined.

Comment. The alteration in titer in this case suggests an infection due to Toxoplasma. It was impossible to obtain weekly studies in this case, so the changes which occurred between July 15 and August 8 are not available.

Case 3. R.B., housewife, age 28.

The patient had an attack of acute chorioretinitis in the left eye in 1948. The inflammation subsided following a tonsillectomy and supportive therapy.

In early March 1952 she developed a recurrence in the same eye. Examination showed a large healed area of chorioretinitis inferior to and adjacent to the optic disc. At the temporal margin of this lesion was a moderate sized acute focus of inflammation. There were numerous vitreous opacities. The right eye was normal and vision was 20/20. Vision in the left eye was 20/25.

A complete survey revealed no cause for the inflammation. The patient was in excellent health.

The toxoplasmin skin test was negative (erythema 0.7 cm. and induration 0.5 cm.). The methylene blue dye test gave the following results:

March 25, 1952	1:64
April 18, 1952	1:16
April 25, 1952	1:64
May 3, 1952	1:256
May 28, 1952	1:64

The patient was treated with isonicotinic acid hydrazide, 100 mg. twice a day for four weeks. The inflammatory focus gradually subsided, and the vitreous opacities slowly disappeared.

Comment. It is not possible to state whether the changing titer in this case is of significance or not. We have not observed such a change in other patients in this series, and are inclined to attribute some significance to the alteration. Many of the sera in this series were examined several times to be sure of the titer.

Case 4. E.G., housewife, age 32.

This patient noticed blurring of the vision in the right eye on January 15, 1952. The blurring gradually became worse and she was hospitalized. Oral cortisone therapy was given for one week, without effect. She was referred for a uveitis survey.

Examination showed the vision in the right eye to be 20/50 and the left to be 20/20. Fundus examination of the right eye showed a large area of acute chorioretinitis above and temporal to the disc. There were large numbers of lipoidal exudates in and beneath the surrounding retina.

A complete uveitis survey did not reveal a cause for the chorioretinal inflammation. The patient appeared to be in good health.

The toxoplasmin skin test was negative (erythema 0.6 cm. and induration 0.6 cm.). The methylene blue dye test showed the following:

Feb. 12, 1952	1:256
April 11, 1952	1:8

The patient was given a course of terramycin for two weeks, followed by streptomycin and para-aminosalicyclic acid for four weeks. At the last examination in April 1952 the inflammation had almost entirely subsided.

Comment. The same comments may be made here as for Case 3. It is possible that if additional sera could have been obtained, the titer would have slowly decreased to 1:8. The titer may have been higher early in the course of the infection.

DISCUSSION

It is possible that isolated toxoplasmic infections, such as those of the eye, may cause a temporary moderate increase in antibodies in the blood. If so, these infections behave differently than those which are acute and generalized. Our study emphasizes the importance of examining the sera of early uveitis cases for evidence of a changing antibody titer.

Evidence is also presented in the tables to show that the serum of over half of all patients with uveitis possesses dye test neutralizing antibodies in a low titer. Most of the sera were positive in a dilution of 1:128 or less. We are often asked what we consider a significant titer, and we reply that a single examination is of no value unless the titer is high (1:256 or more). It is more important in an early case to test the antibody level at weekly intervals for a month to determine whether a change occurs.

The skin test antigen used on the patients of this series was prepared according to the description of Frenkel.[1] Indurations of over 10 mm. with erythema of 10 to 20 mm. were considered as indicating a positive test if the control was negative. Our results show that the skin test is less commonly positive than the methylene blue dye test in uveitis patients. The comparative results are as follows:

Skin Test	Dye Test
Pos.	Pos.
45	129
Neg.	Neg.
293	209

The low percentage of positive skin tests may be accounted for by the fact that a test showing less than 10 mm. induration was considered doubtful or negative. Some authors consider 0.5 cm. induration or more as positive. Because most of the dye test titers were of a low order it is possible that the dermal

sensitivity to toxoplasmin had diminished or been lost in many patients.

Sabin and others have emphasized that the skin test, when found to be positive, is not diagnostic of a recent or active infection. They also state that its value is greatest in routine population surveys for determination of the incidence of the disease. It is known that the number of positive reactors increases in all groups over the age of 20. Sufficient information is not available to make statements concerning the reversal of a negative skin test to a positive in the younger age groups.

It is of interest in this study that the incidence of positive dye tests was higher in all groups with chorioretinitis.

With the exception of a few patients in the first decade of life none of the patients had a history suggesting an acute infection due to Toxoplasma or systemic evidence of an acute or chronic toxoplasmosis.

It might be re-emphasized that there is no characteristic ophthalmoscopic picture of toxoplasmosis. In the acute stage, single or multiple, large or small lesions may be located in any portion of the fundus. The primary lesion may be localized in the choroid or retina, but the latter seems to be most commonly affected. Considerable destruction of the choroid and retina occurs at the site of the most acute inflammation. Satellite lesions developing at the edge of a previous healed lesion are suggestive of toxoplasmosis. It is uncertain from these studies whether a primary iridocyclitis in the absence of posterior segment lesions may occur in toxoplasmosis. We were unable to perform further studies on the one patient with iridocyclitis who had a titer of 1:512 at the initial examination.

SUMMARY AND CONCLUSIONS

1. Three hundred thirty-eight cases of uveitis in all age groups were studied for evidence of toxoplasmosis. Complete uveitis surveys were done on all cases. The methylene blue dye test and toxoplasmin skin test were used to detect this disease.

2. The serum of over 50 per cent of the patients showed a positive methylene blue dye test most often in low titer.

3. Approximately 15 per cent of the patients had positive toxoplasmin skin tests.

4. Four cases of posterior uveitis are reported which had a change in titer of the serum during the course of the disease. Two of these cases had such a significant change that they could be considered as probable cases of toxoplasmic uveitis.

5. A single positive methylene blue dye test in a titer of 1:128 or less is of no contributory value in establishing the diagnosis of toxoplasmic uveitis. The serum should be tested repeatedly for evidence of a changing titer.

6. A positive skin test was encountered less frequently than a positive dye test, possibly because we required that the skin show at least 10 mm. induration or more before the test was considered positive.

7. The incidence of positive dye tests is higher in patients with posterior uveitis than in patients with anterior uveitis.

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DISCUSSION

HELENOR CAMPBELL WILDER, Washington, D. C.: Dr. Hogan has made a valuable contribution to the subject of ocular toxoplasmosis in adults. His demonstration of a changing antibody titer in patients with probable ocular toxoplasmosis and his observation that an isolated lesion may not supply sufficient stimulation to produce a general antibody response explain the difficulty of establishing a definite clinical diagnosis of this disease on serologic evidence.

Unfortunately the correlation of serologic with pathologic observations has also presented almost insurmountable difficulties. Although protozoa have been found in over 50 eyes of adults in the Registry of Ophthalmic Pathology at the Armed Forces Institute of Pathology, the eyes were enucleated from one to twenty years ago and many of the patients cannot now be located. Moreover, a low or possibly negative dye test in a patient from whom the only known active focus of infection was removed six, ten or more years earlier, would not be significant. Even from those whose eyes were removed within more recent years it has been difficult to obtain a single specimen of serum. To obtain a series of specimens, as Dr. Hogan's work indicates is necessary for definitive clinical diagnosis, would be almost impossible. In spite of these problems of correlation between ocular disease and serologic findings, evidence is piling up for Toxoplasma as a not uncommon cause of granulomatous chorioretinitis in adults.

Dr. Hogan has observed that there is no characteristic ophthalmoscopic picture of toxoplasmosis because, as he has pointed out, the lesions may be single, multiple, large or small, and located anywhere in the fundus. This, coupled with the fact that the fundus may sometimes be at least partially obscured by the presence of keratic precipitates, synechias, pupillary membrane, cataract, or inflammatory cells in the vitreous must, indeed, give an extremely variable ophthalmoscopic picture. However, in enucleated eyes, the chorioretinal lesions in which protozoa are found present a strikingly uniform appearance on microscopic examination, even though, as in Dr. Hogan's cases, their location and size are not always the same. They involve the retina, choroid and sometimes the sclera. They are focal and granulomatous, although there may be disseminated secondary inflammatory reaction elsewhere in the globe. It is in the necrotic portion of the retina and not in the epithelioid and giant cells that the protozoa are found. In celloidin sections their morphologic characteristics are usually beautifully preserved, and pseudocysts, intracellular forms and crescents can be identified.

To say that these organisms are a more common cause of chorioretinitis than tuberculosis is not justified at the present time, but it can be asserted that it is more often possible to demonstrate protozoa in chorioretinal lesions than it is to demonstrate tubercle bacilli. The etiology of a vast number of cases of uveitis, of course, still remains undetermined. However, the finding of protozoa in chorioretinal lesions in adults, supports Dr. Hogan's demonstration of significant titer for Toxoplasma, also in adults with posterior uveitis. Together these clinical and pathologic observations indicate that a protozoal rather than a bacterial agent should be considered in some of the hitherto obscure cases of chorioretinitis.

HARRY A. FELDMAN, M.D., Syracuse, N. Y.: Dr. Hogan's paper raises a number of interesting questions whose specific answers, unfortunately, are not yet at hand. I believe that we all are agreed that congenital toxoplasmosis frequently results in damage to the eye. In our own experience, we have encountered only one child with congenital toxoplasmosis in whom it was not possible to demonstrate chorioretinitis. She was the granddaughter of an ophthalmologist, and repeated eye examinations revealed only a squint. When we turn to the question of ocular damage as the result of acquired toxoplasmosis, we begin to stand on somewhat less firm footing. I believe that there are two mechanisms whereby the eye may be infected by Toxoplasma: Either directly, or indirectly by way of the blood stream. While we have no evidence which supports the concept of direct infection, there is considerable circumstantial evidence which indi-

cates that the blood stream is of importance in the transportation of parasites to various parts of the body. The latter appears to be the method whereby the fetus becomes infected *in utero*. In this situation, the ordinary inapparent infection fortuitously has occurred during pregnancy.

The most precise and satisfying way in which to make a specific diagnosis in an infectious disease is to isolate and maintain the living causative agent. Since this is not always feasible, a number of indirect methods have been developed which have different degrees of reliability in different circumstances. The most useful of these indirect procedures are those of serology. The development of the rabbit neutralization test by Sabin provided a method for demonstrating antibodies for Toxoplasma, but the mechanical difficulties involved in performing this test did not permit widespread testing. Because a limited number of sera were examined with the rabbit test, a positive reaction (titration was not practical with this test) was frequently interpreted as having confirmed the clinical diagnosis. The recently developed dye and complement-fixation tests, permit us to titrate antibody and to study many specimens so that we now have a great deal of new information about toxoplasmosis. In addition, we also have available a useful skin test.

Laboratory tests, at best, are tools and require considerable application before their limits may be defined. Let me mention one or two principles which are broadly applicable to the interpretation of serologic data. First, a single positive determination is of limited value unless we are dealing with an exotic disease for which antibodies are normally absent from the general population. Therefore, in dealing with a specific case we must examine two different serum samples from the same person, for changing titers are much more significant than are stable titers. Dr. Hogan very nicely has attempted this. As a corollary, serologists usually insist when two sera are examined from the same person that their antibody contents are best compared when both specimens are examined simultaneously. It is generally accepted that a significant difference between titers must represent a difference of two tubes in the determination. In other words, where fourfold dilutions are being used (such as in the Toxoplasma dye test) the titer would have to go up sixteen times in order to be considered meaningful; this calls, for example, for an increase from an initial titer of 1:64 to 1:1024 in the second specimen.

It is known from studies of experimental infections in the monkey, rat, pigeon and guinea pig that high titers of Toxoplasma antibody may be detected by the dye test within fourteen days of infection, and certainly by twenty-one days. It is well-nigh impossible to elicit similar information from humans, especially since one can never be quite certain as to when and where they received their infections. In two cases of acquired toxoplasmosis that we have studied within the past two years, both with widespread, fatal disease unaccompanied by detectable eye lesions, dye test antibody was found in significant amount within the first two weeks of illness in one but not in the other patient. Although the first serum specimen, obtained fourteen days after the onset of symptoms in this second patient was entirely negative, the second sample unfortunately not secured until the forty-eighth day was positive in a titer of 1:16,384.

All the evidence available at present indicates that dye test titers not only become positive early, but are maintained at high levels, between 1:1024 and 1:4096 at least for a period of several years. The complement-fixation reaction behaves somewhat differently. It seems (this information is based upon studies of infants who are born with active infections) that the complement-fixation test is negative when the infection is active but becomes positive as the clinical state improves; these antibodies tend to disappear in about two to four years. We, as well as others, have been trying to apply this to the study of acquired infections, feeling that perhaps we can determine that active disease exists if the dye test titer becomes highly positive while the complement-fixation titer is still negative. We must, of course, be aware of the reverse situation where the dye test titer has been high for several years and the complement-fixation has already become negative.

Several years ago we began to apply these new technics broadly in order to obtain background information which would lead to a better understanding of the serologic findings in toxoplasmosis. First, we conducted two skin test surveys of normal inhabitants of Cincinnati, Ohio and Syracuse, New York. Figure 1 illustrates the incidence of positive reactors in the two surveys. There are some differences between the patterns observed in the two cities, but in each instance there is a strikingly high incidence of positive reactors in the adult populations. The antigen used in this case was of chick embryo origin and each individual was tested also with normal, control egg material. It is obvious from this information that a

COMPARATIVE INCIDENCES OF SKIN REACTORS TO TOXOPLASMIC ANTIGEN AMONG "NORMAL" RESIDENTS OF CINCINNATI AND SYRACUSE

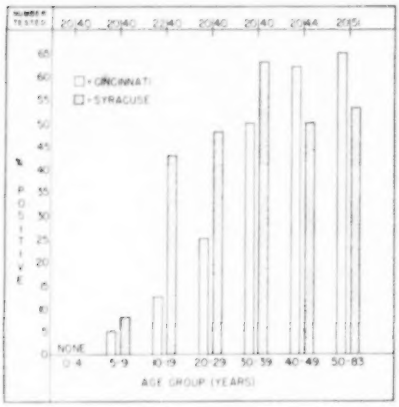

FIGURE 1.

positive skin test is of little diagnostic significance in an individual case. Of additional importance in this respect is that we found one third of a group of nonreactors to the skin test to have serum antibodies by the dye test.

We have now extended these studies to include serum surveys of the normal populations of a number of major American cities as well as several isolated populations. Our findings among 144 normal inhabitants of Pittsburgh, Pennsylvania, are shown in figure 2. Here, too, it is rather striking to find how many adults have antibodies for Toxoplasma. The results obtained among the residents of Tahiti seem to have the highest degree of infection (fig. 3). Figure 4 is a composite of data derived from the inhabitants of several cities in the United States and the pattern is essentially the same. These data illustrate very clearly that Toxoplasma serologic findings which are obtained from adults are to be interpreted with great caution.

For the purpose of the immediate discussion, I have gathered together information from 144 patients whose sera were sent to me for examination because the patients had diagnoses of either chorioretinitis or uveitis. When we tabulate, by ages, the serologic results from these patients, we can see that the very young have no antibodies and that there is a gradual increase of positive reactors with increasing age (fig. 5). In figure 6, the titers are plotted against age as was done in the normal population studies, and I believe that you will agree with me that there is no obvious difference. Let me add also that in each instance the serum of the eye disease patients was studied at a time in their illness when their antibody titers should have been significantly high, assuming that infection had occurred within the preceding two years.

The data from the eye patients have been plotted alongside the data derived from the survey of the normal population of Pittsburgh

DISTRIBUTION BY AGES OF TOXOPLASMA ANTIBODY TITERS (DYE TEST) DETECTED AMONG 70 OF 144 RESIDENTS OF PITTSBURGH, PA

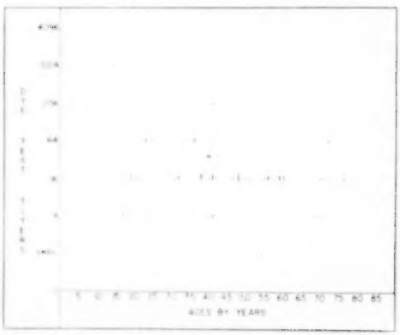

FIGURE 2.

DISTRIBUTION BY AGES OF TOXOPLASMA ANTIBODY TITERS (DYE TEST) DETECTED AMONG 99 OF 121 RESIDENTS OF TAHITI

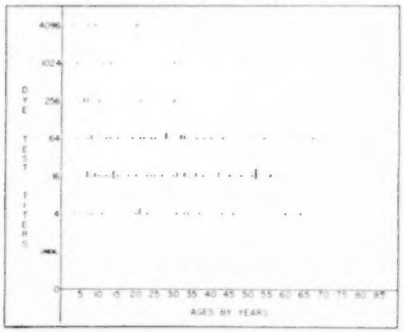

FIGURE 3.

DISTRIBUTION BY AGES OF TOXOPLASMA ANTIBODY TITERS (DYE TEST) DETECTED IN 280 OF 682 RESIDENTS OF THE UNITED STATES

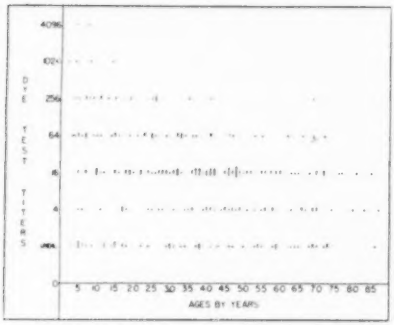

FIGURE 4.

INCIDENCE OF ANTIBODIES FOR TOXOPLASMA AMONG 144 PATIENTS WITH DIAGNOSES OF CHORIO-RETINITIS OR UVEITIS

AGE GROUP (YRS.)	NO.	NEG.	POS.	% POS.
0-4	68	68	0	0
5-9	13	12	1	8
10-19	16	13	3	19
20-29	32	15	17	53
30-64	15	10	5	33
TOTALS	144	118	26	18

FIGURE 5.

DISTRIBUTION BY AGES OF TOXOPLASMA ANTIBODY TITERS (DYE TEST) DETECTED IN 26 OF 144 PATIENTS WITH CHORIO-RETINITIS OR UVEITIS

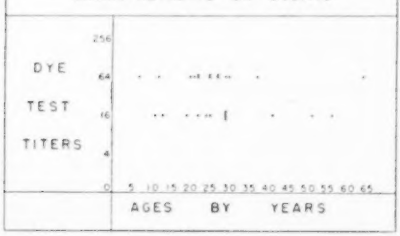

FIGURE 6.

COMPARATIVE FREQUENCY OF ANTIBODIES FOR TOXOPLASMA AMONG 144 PATIENTS WITH CHORIO-RETINITIS OR UVEITIS AND 144 "NORMAL" RESIDENTS OF PITTSBURGH, PA.

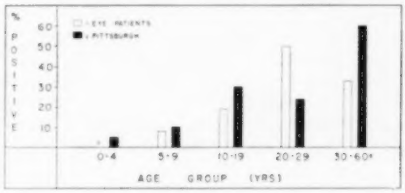

FIGURE 7.

(fig. 7). There happened to be 144 persons in each group. Some allowance should be made, of course, for the number involved in some of the age levels. You will note that here, too, there is very little real difference between the patients studied because they had either chorioretinitis or uveitis and those who were considered to be normal inhabitants of a typical American city. I have included only those people with titers of 1:16 or higher in the positive group since most workers consider this to be the minimal amount of antibody that is significant; none of the eye patients had a titer higher than 1:64. If they had had recent infections, we would have expected their titers to be at least 1:1024 or higher. I believe that what all this adds up to is that (1) many people have antibodies for Toxoplasma; (2) if toxoplasmosis produces acquired eye disease, then it must do so with rarity; (3) it emphasizes again that significant serologic findings depend upon the demonstration of changing antibody titers.

Naturally, we are concerned with the question of where man gets his infections with Toxoplasma. In several animal studies which we have conducted, we noted that street dogs and cats and laboratory guinea pigs frequently have antibodies for Toxoplasma. This hardly proves that any of them has anything to do with human infections, but it certainly demonstrates that these species may be a reservoir for human disease. Implicating any of these animals on the basis of serologic data in a given human case will be very difficult, indeed.

MICHAEL J. HOGAN, M.D., San Francisco, Calif.: I wish to thank the discussers for their detailed statements and kind words. I am unable to correlate the low incidence of positive dye test titers in patients with uveitis during the presence of an active infection. The only possible explanation might be that we are dealing with an organism which varies

greatly in virulence. It is capable of producing a severe uveitis and at the same time causes no significant change in antibody titer in the blood.

A number of cases have been reported in Europe during the past two years of ocular toxoplasmosis in which individual dye test titers were reported, most often in very low titer. I doubt if they are examples of toxoplasmosis.

We have changed our method of skin testing to the egg antigen, as Dr. Feldman mentioned. I was interested that approximately half of his 144 cases also had positive dye tests in a low titer. In a survey of 200 pregnant females which we recently did, in which we ended up with about 175, we analyzed the serum at the third month and again at eight months. Our findings in that series of patients corresponded very well with the incidence of positive dye tests in the uveitis series and also with those reported by Dr. Feldman.

I might add one other animal to his list. A very interesting article was reported from Denmark by Christiansen in which he found that wild hares in Denmark apparently are subject to acute toxoplasmosis. He was able to study the hares in great detail and recovered the organism from them and found that they were antigenically similar to those in the United States.

THE OCULAR EFFECTS OF METHYL ALCOHOL POISONING:

Report of a Catastrophe Involving Three Hundred and Twenty Persons

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BY INVITATION
and
F. PHINIZY CALHOUN, JR., M.D.
ATLANTA, GA.

ON OCTOBER 20, 1951 a large quantity of bootleg whiskey containing 35 per cent methyl alcohol and 15 per cent ethyl alcohol was distributed in Atlanta, Georgia. During the succeeding seven days, three hundred and twenty persons sought emergency medical care at Grady Memorial Hospital because of symptoms attributable to the ingestion of this mixture. Twenty-four persons died before or shortly after reaching the hospital and thirteen died on the medical wards, making a total of thirty-seven deaths. A general report of these cases has been published elsewhere.[5]

Ophthalmic observations were made by one of the authors (Benton) on a large proportion of the patients immediately upon their acceptance to the hospital emergency room. Data were recorded concerning the amount of contaminated whiskey consumed and the date thereof, onset and character of symptoms, the vision, pupillary reaction to light, visual fields (confrontation method) and ophthalmoscopic appearance of the fundi. Every patient admitted to a hospital bed was examined daily until the time of his discharge and then at gradually longer intervals in the eye clinic. Measurements of visual acuity and central visual fields and observations of the ocular fundi were made at each visit during the eight month follow-up period. Patients who were never admitted to the hospital were asked to report to the eye clinic for examination. One hundred and twenty-three patients returned for re-examination.

The symptoms of acute methyl alcohol poisoning usually develop eighteen to forty-eight hours after ingestion, but in a few instances transitory symptoms were noted within one hour. The patients complained of visual disturbances, weakness, abdominal pain, nausea and vomiting, headache, dizziness, and shortness of breath. Some patients had consumed as little as 90 cc. of the alcoholic mixture and others had drunk as much as 750 cc. Within this range there was no close correlation between the severity of symptoms and the quantity of methyl alcohol consumed.

The initial visual symptoms ranged from spots before the eyes to complete blindness. Many patients complained of whitish or grayish misty vision. The visual acuity was either normal or markedly reduced. The patients with severe visual loss could count fingers only in the mid-periphery of their visual field. Three patients who were conscious had no light perception in either eye. Characteristically, the initially reduced vision showed an early recovery which was in some cases only transitory. Many patients experienced full return of vision

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during the first hour of treatment by intravenous alkaline fluids. All patients who regained and retained normal visual acuity did so within six days after treatment was begun. If the vision did not return to normal in six days, it invariably dropped again to a very low level. Only 3 patients, all nearly or completely blind at the time of hospital admission, failed to exhibit any permanent or temporary improvement in vision.

In the acute phase of poisoning, diminution of the pupillary reaction to light occurred in all patients with impaired vision and in many patients with normal vision. The degree of impairment of the pupillary light reflex proved to be of considerable prognostic value. Patients with dilated, fixed pupils usually died; if they recovered they always had severe visual damage. Lesser degrees of impairment in the pupillary response to light were indicative of a more favorable outcome and no patient with normally reacting pupils had permanent visual loss. These findings are illustrated in figure 1.

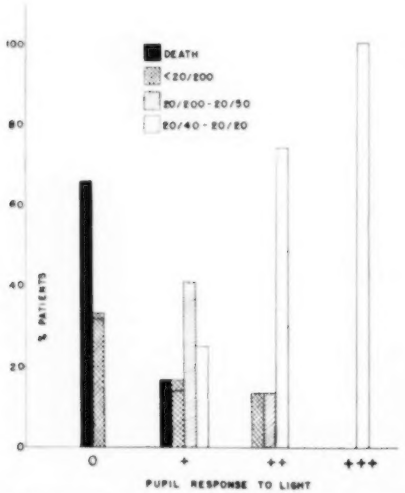

FIG. 1.—Correlation of pupillary response to light with fatality and final vision (+++ equals normal reaction).

The ophthalmoscopically visible fundus changes were always identical in type and sequence of appearance and varied only in intensity from one patient to the next. A hyperemia of the optic disc could be seen at the time symptoms of visual loss developed. The reddish color of the papilla persisted from one to seven days. From six to twenty-four hours after the hyperemia became visible, there developed a whitish striated edema of the disc margins and adjacent retina. Edema was most extensive along the course of the major retinal vessels, and it persisted for ten to sixty days. The peripapillary retinal edema appeared to be chiefly in the nerve fiber layer. Engorgement of the retinal veins usually accompanied the retinal edema and followed a similar course. These characteristic fundus changes were seen in 87 per cent of patients with initial visual loss and in every patient who later showed permanent impairment of vision. Mild or moderate retinal edema was followed by complete recovery of vision in some cases, blindness in others. It was found, however, that all patients who had severe retinal edema and most patients with moderate retinal edema had some degree of permanent visual loss.

In patients with severe ocular damage an atrophy of the optic disc became visible in thirty to sixty days. Usually the optic nerve atrophy was identical in appearance to so-called primary optic atrophy, although occasionally a cupping of the nerve head that simulated glaucoma was seen.

In 5 patients there was a striking difference between the visual acuity of the two eyes, even though the ophthalmoscopic changes were always bilaterally equal. In 4 of the 5 such cases, the left eye was the most severely impaired. The shape of the scotomas offered the explanation of this difference in visual acuity. In the central field of the better

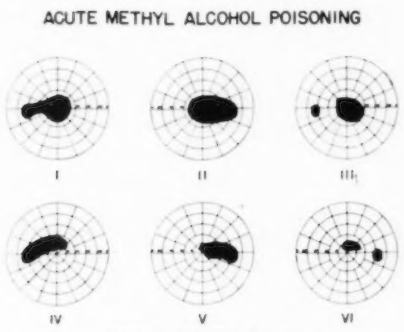

FIG. 2—Acute methyl alcohol poisoning. Early central field defects (5/1000 form).

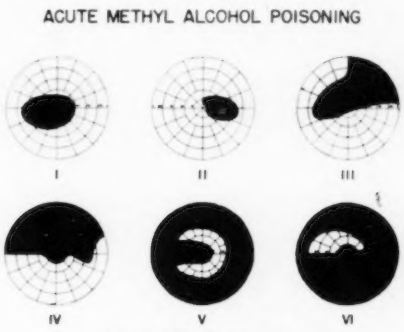

FIG. 3—Acute methyl alcohol poisoning. Late central field defects (5/1000 form).

eye, the scotoma extended from the blind spot like an open mouth preparing to engulf the fixation area. In the opposite eye a complete cecocentral scotoma obliterated the area of critical vision. After four to six months, the visual acuity in the better eye began to decline and approach the level of the other eye.

The typical alteration of the visual field was a cecocentral scotoma of considerable density. Frequently this type of scotoma was incomplete so that it arched above or around the fixation point and did not impair central visual acuity. A few patients had a pericentral or paracentral scotoma not connected with the blind spot (fig. 2). In only 2 patients was the peripheral field constricted in the early stages. After two to four months various and bizarre alterations appeared in the visual fields. Defects of the fiber-bundle type and peripheral constriction usually combined to eliminate all or most of the field of vision (fig. 3). The symptoms and signs described above are similar to those reported previously by other authors.[2,3,4,6,10,14,17,20,21]

Chemical studies revealed the presence of methyl alcohol in the blood, urine, spinal fluid, aqueous and vitreous humors of the eye. The concentration was always greater in the vitreous than in the aqueous of the eight eyes tested. A trace of formaldehyde was found in the vitreous of one eye. Formic acid was not detected in the aqueous or vitreous of either eye in one fatal case.

The most important alteration in the biochemical status of persons poisoned with methyl alcohol occurs in the carbon dioxide combining capacity of the blood. The blood carbon dioxide was measured on every patient immediately upon his acceptance into the emergency clinic. The degree of acidosis proved to be an invaluable guide to diagnosis, therapy, and prognosis. This point has been repeatedly stressed by Røe and others since 1943.[4,7,14-17] The blood carbon dioxide was normal (above 26 milliequivalents per liter, or 55 volumes per cent) in 188 patients. Not one patient in this group had genuine symptoms or signs of methanol poisoning and undoubtedly many of these patients drank none of the contaminated whiskey. No treatment was given any patient who had a normal blood carbon dioxide. Follow-up studies were done two to six months later on 94 or 50 per cent of this group of patients, and not one had evidence of any visual damage from methyl alcohol. The blood carbon dioxide was 25 milliequivalents per liter or below in the re-

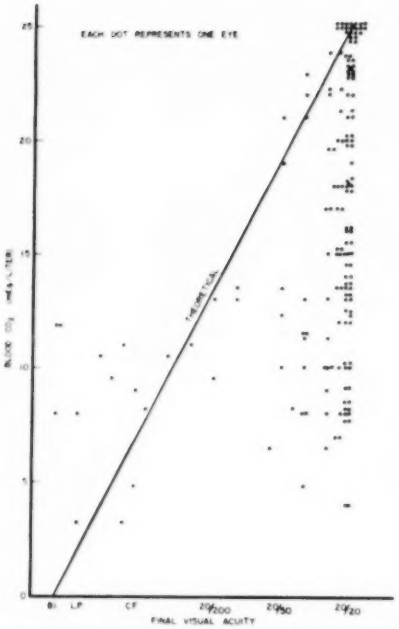

FIG. 4.—Correlation of initial blood carbon dioxide with final visual acuity. (The wide scattering of the dots on the graph does not conform to the theoretical correlation as represented by the diagonal line.)

maining 132 patients. Thirty-seven of these patients died. All fatal cases had a severe acidosis with the blood carbon dioxide usually below 10 milliequivalents per liter. Death was always characterized by cessation of respiration from medullary paralysis. Convulsions were common. The heart usually continued to beat for several minutes after respirations stopped. When it was possible to obtain a history on the patients who died, it was learned that they were always blind or nearly blind before their final loss of consciousness. Ninety-five patients with a low blood carbon dioxide survived the poisoning. Sixty-two of these patients had visual symptoms. Objective ophthalmoscopic findings were present only in patients with visual symptoms, and occurred in 87 per cent of those. The relation of blood carbon dioxide before treatment to the final visual acuity showed that chances of restoration of complete vision was possible at almost any carbon dioxide level, but patients with a very low carbon dioxide level frequently had permanent loss of vision. No patient with a carbon dioxide level above 12 milliequivalents per liter had a final visual acuity worse than 20/200 in either eye. These findings are illustrated graphically in figure 4.

Treatment was directed toward the elimination of acidosis in those patients with a low blood carbon dioxide. Bicarbonate of soda was taken by mouth in patients whose symptoms were mild and whose blood carbon dioxide was between 20 and 25 milliequivalents per liter. Patients with a very low carbon dioxide and severe symptoms were given soda bicarbonate intravenously. The available supply of already prepared alkaline solutions for intravenous administration was quickly exhausted. New solutions were readily prepared by dissolving the dry powder from clean, previously unopened boxes of bicarbonate in flasks of sterile glucose, saline, or distilled water. Several hundred such solutions containing 25 to 50 grams of bicarbonate per liter were given intravenously with no ill effects. Symptoms of alkalosis rarely developed even though the blood carbon dioxide rose to 40 or 50 milliequivalents per liter in some patients. Because of the strong tendency for acidosis to recur, it was found that alkali therapy had to be continued for a minimum of three days, with constant check of the blood carbon dioxide or urine pH. This was strikingly demonstrated in 4 patients who were treated in the emergency clinic and failed to follow instructions to take soda bicarbonate orally at home. They were brought back the next day in severe acidosis and died.

Adequate correction of acidosis in patients with severe methyl alcohol poisoning will not invariably save life or vision. If the acidosis is severe or has persisted for several hours, death may result in spite of energetic treatment, or if the patient survives, he may have marked loss of vision.

Also, inadequate alkali therapy may result in a prolonged state of mild or moderate acidosis and permanent loss of vision. These observations can be illustrated by the following examples:

Cases 6, 7 and 8 demonstrated prolonged acidosis as the result of inadequate alkalinization.

Case 6. This Negro boy aged 19, had consumed a half pint of the methanol mixture two days before admission. Visual acuity was reduced to 20/200 in the right eye and finger counting in the left eye. The blood carbon dioxide was 9 milliequivalents (mEq.) per liter. Sixty grams of soda bicarbonate intravenously quickly elevated the blood carbon dioxide to 27 mEq. per liter, but the following day it had dropped to 17 mEq. per liter. The administration of 16 grams of soda by mouth returned the blood carbon dioxide to 28 mEq. per liter. The final visual acuity was O.D. 20/30 and O.S., fingers at 18 inches. A cecocentral scotoma persisted in the left central field whereas a pericecal scotoma in the right field spared the fixation area.

Case 7. This 26-year-old Negro male drank a half pint of the poisoned whiskey. Within 18 hours the vision became blurred. He did not seek treatment for another 18 hours, at which time his vision was reduced to finger counting at 10 inches. The blood carbon dioxide was 13 mEq. per liter. Fifty grams of soda bicarbonate intravenously elevated the blood carbon dioxide to 30.5 mEq. per liter. The following day the blood carbon dioxide had fallen to 16 mEq. per liter. Thirty-five grams of soda by mouth brought the blood carbon dioxide up to 22 mEq. per liter. The final visual acuity was O.D., 20/200 and O.S., 20/100.

Case 8. This 40-year-old Negro man had consumed a half pint of the methyl alcohol mixture. Dimness of vision was experienced after 12 hours. The blood carbon dioxide was 15 mEq. per liter. For four days the blood carbon dioxide remained below 20 mEq. per liter in spite of an initial dose of 50 grams of bicarbonate of soda intravenously followed by oral doses of 30 to 45 grams daily. Although this patient could count fingers accurately at 10 inches at the time of admission, he became and remained totally blind.

Cases 3 and 5 show the tendency for acidosis to recur after initial correction.

Case 3. This Negro woman, aged 34, became blind 48 hours after consuming a half pint of the contaminated bootleg whiskey. The initial blood carbon dioxide was 9 mEq. per liter. Soda bicarbonate was given intravenously in doses of 35 grams and later 20 grams. The blood carbon dioxide remained above 30 mEq. per liter the following 36 hours and then fell to 23 mEq. per liter. No further treatment was given. The final visual acuity was O.D., 20/200 and O.S., fingers at 6 inches. A cecocentral scotoma persisted in the left field whereas the right fixation area was spared by a pericecal scotoma.

Case 5. This 37-year-old Negro man drank "a little bit" of the methyl alcohol whiskey eight hours before being brought to the hospital. Amblyopia was severe and the blood carbon dioxide was 5 mEq. per liter. After 75 grams of soda intravenously the blood carbon dioxide became normal and remained so during the following day. Twenty-four hours later the blood carbon dioxide had dropped to 16 mEq. per liter but was again elevated to normal by the oral administration of 30 grams of soda. The final visual acuity was O.D., 20/40 and O.S., fingers at 18 inches. Again the difference in visual acuity between the two eyes was due to a cecocentral scotoma in the left eye and a pericentral scotoma in the right eye.

The poor vision in cases 2 and 4 is evidence that adequate alkali therapy will not always prevent blindness.

Case 2. This 43-year-old Negro man drank a moderate quantity of the poisoned whiskey over a two-day period. Blurred vision was experienced one day later. The patient was not brought to the hospital until the following day, at which time he was blind. The blood carbon dioxide was 8 mEq. per liter. One hundred and twenty grams of soda intravenously elevated the blood carbon dioxide to 50 mEq. per liter, where it remained for at least two

CASES

DAY		1 L.R.	2 D.N.	3 R.F.	4 L.S.	5 W.G.	6 R.H.	7 W.M.	8 W.R.M.
1	CO_2 Soda CO_2 Soda	4 100 gm. 42	8 120 gm. 52	9 35 gm. 30 20 gm.	3 40 gm. 33 30 gm.	5 75 gm. 26	9 60 gm. 27	13 50 gm. 30.5	15 50 gm. 22
2	CO_2 Soda	43	49	36	42	38	17 16 gm.	16 35 gm.	12 45 gm.
3	CO_2 Soda			23	45	16 30 gm.	28	22 20 gm.	19 30 gm.
4	CO_2 Soda					35			19 30 gm.
Final Vision	O. D. O. S.	20/20 20/20	L.P. Blind	20/200 C.F.	C.F. L.P.	20/40 C.F.	20/30 C.F.	20/200 20/100	Blind Blind

days. Inspite of this he gained only a little vision and then again became blind.

Case 4. A 47-year-old Negro woman drank a half glass of the poisoned whiskey. There was headache, nausea and vomiting in six hours followed the next day by blurring of vision. The blood carbon dioxide at the time of hospital admission was 3.2 mEq. per liter. After 40 and 30 grams of soda intravenously the blood carbon dioxide remained over 40 mEq. per liter for two days. The visual acuity improved in two months to O.D., 20/100 and O.S., fingers at 6 inches, then dropped to finger counting in the right eye and light perception in the left.

Normal vision may result even in the face of initially low blood carbon dioxide if treatment is prompt.

Case 1. This 20-year-old Negro girl experienced abdominal pain and poor vision 24 hours after drinking a half glass of the bootleg whiskey. The blood carbon dioxide was 4 mEq. per liter. After 100 grams of soda intravenously the blood carbon dioxide was well above normal for at least two days. The visual acuity quickly returned to normal in both eyes and has remained the same.

ACTH was given to four patients with no beneficial effect. Spinal fluid exchange therapy was carried out several times on 3 patients who had severe visual loss.[11,19] No improvement resulted from this treatment. Ethyl alcohol was given intravenously to only one patient. Although definite improvement was observed, this is not given here as evidence in favor of the belief that ethyl alcohol should be used in the treatment of methyl alcohol poisoning.[1,2,14-17]

Histologic examinations on six eyes removed six to eighteen hours after death showed degeneration of the ganglion cells of the retina, slight edema of the nerve fiber layer near the disc, some degeneration of the rod and cone layer with accumulation of a small amount of albuminous fluid under the retina near the disc. All these changes could have been the results of normal post-mortem degeneration, particularly since the changes were more prominent in those eyes removed at eighteen hours than in those removed at six hours after death. Other investigators have presented considerable evidence that degeneration of the retinal ganglion cells is a specific toxic effect of methyl alcohol.[6,8,14-17]

Other pathologic findings of interest were a mild to moderate edema of the brain and an acute pancreatitis. Studies of cerebral blood flow were done on five patients with severe poisoning. The average arterial oxygen saturation was 92 per cent. Cerebral blood flow was reduced 33 per cent and cerebral oxygen consumption was diminished 35 per cent. Serum amylase determinations on several patients showed moderate to marked high levels, therefore it was felt that acute pancreatitis was often the cause of the severe abdominal pains in these patients.[5]

Many theories have been advanced to explain the mode of toxic action of methyl alcohol in the human body.[6,9,13,14-18] It is unfortunate that laboratory animals do not respond to this agent in a manner similar to the human. Acidosis almost never develops and the animals do not often appear to go blind. Fink[6] and also McGregor[8] have described degeneration of the retinal ganglion cells in animals poisoned with methyl alcohol, but this has been denied by Røe.[14-17] Conclusions from experiments on animals should be applied to humans with great caution and reservation.

Apparently methyl alcohol breaks down slowly in the body to formaldehyde and formic acid. It appears unlikely that any of these chemicals acts directly on the retina or other nerve tissue. Methyl alcohol is rapidly distributed throughout all body fluids but symptoms of poisoning rarely develop in less than eighteen hours after ingestion. According to the theory of Rohr,[13] methyl alcohol or one of its breakdown products

slowly combines with the iron catalyst of the oxydase system rendering it inactive and causing a tissue anoxia. This process is accelerated in the presence of acidosis.[14-17] Because the retina has the highest oxygen requirement per unit concentration of iron of any body tissue, it is not surprising that this delicate ocular membrane should be damaged in methyl alcohol poisoning. An indirect toxic action, as just described, offers a ready explanation for the parallelism of ocular symptoms and signs of methanol poisoning with the amblyopia of lead, arsenic, thallium, or carbon disulfide poisoning or even that of severe malnutrition.[12] Recently Potts and Johnson[9] found evidence that the proximal toxic agent in methanol poisoning may be formaldehyde, a potent inhibitor of retinal oxidation and glycolysis. The acidosis does not appear to be the cause of amblyopia but it does act as an accelerating force. If acidosis can be corrected before permanent ocular damage has resulted, a return of normal visual acuity can be expected. If retinal tissue hypoxia has existed long enough for irreversible degeneration of the ganglion cells to occur, treatment may prevent death but visual impairment will be permanent. Until a specific chemical is found that will prevent or release the combination of methyl alcohol or its products with the iron oxydase system, rapid, intense, and prolonged alkalinization appears to be the most important phase of treatment for acute methyl alcohol poisoning.

SUMMARY

Clinical and pathologic observations on a group of three hundred and twenty patients with acute methyl alcohol poisoning are reported. There were thirty-seven deaths.

Visual symptoms, occurring eighteen to forty-eight hours after ingestion of methanol, included blurred vision, loss of central vision and complete blindness. The pupils reacted sluggishly or not at all to light. Absence of the pupillary light reflex was a sign of poor prognosis for life or eventual restoration of visual acuity. The visible retinal changes were hyperemia of the optic nerve head and superficial edema of the papilla and surrounding retina, and later a simple atrophy of the optic nerve. All patients with severe retinal edema had some degree of permanent visual loss. The earliest central field defect was usually a cecocentral scotoma. Later more complex types of visual field defects appeared.

Acidosis was present in every severely poisoned patient. The degree of acidosis paralleled the severity of general and ocular symptoms.

Partial or complete recovery of the initially reduced visual acuity was observed in most patients. If the visual acuity did not return to normal within six days after treatment was begun, it invariably dropped again to a very low level. The final vision was 20/200 or less in both eyes of six patients and in one eye of three patients.

Histologic studies on six eyes enucleated after death revealed changes consistent with post-mortem degeneration.

On the basis of the results obtained in this series of cases, the most effective treatment of acute methyl alcohol poisoning consists of intensive and prolonged alkalinization.

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DISCUSSION

ALBERT M. POTTS, M.D., Cleveland, Ohio (by invitation): It is at once a great pleasure and privilege to be asked to discuss this report of Drs. Benton and Calhoun. They are without doubt the two living ophthalmologists with the greatest experience in clinical methyl alcohol poisoning and the observations which they made have the virtue of high significance because of the large number of cases observed.

The importance of methanol poisoning as an ever-present menace lies in the very fact that such a catastrophe as the one reported could occur within the past year. Its seriousness is underlined by the statistic that of all cases reported here showing any symptoms 28 per cent, or one for every three and one half patients, died (320 less 188 symptom-free = 132 cases of which 37 deaths = 28 per cent). Of the survivors an equal proportion had some measurable visual damage and 10 per cent of the survivors were made blind, retaining vision of 20/200 or less.

Although the number of individuals involved in this instance is an unprecedentedly high one, instances of smaller outbreaks of methyl alcohol poisoning are still not uncommon among the civilian population. In the Armed Forces, where access to ethyl alcohol is restricted, methanol is a constant hazard as some of Dr. Calhoun's earlier papers testify. In one series of World War II veterans, methanol poisoning accounted for 6 per cent of blindness from all causes and this may be considered a representative figure.

Wherever methanol poisoning appears one finds avarice and greed and the placing of

financial gain above human life itself. When methanol poisoning first became a problem at the beginning of the present century, this was manifest in the initial denial, then concealment, of the toxicity of methanol by its manufacturers. This phase of concealment is well illustrated by the slides of labels of methanol 1904 vintage published by Wood and Buller. I should like to ask if Dr. Benton can tell us briefly just what legal recourse was available to the surviving victims and what present legal measures exist to prevent recurrence of such mass destruction.

One is pleased to note that the authors devote much of their effort in applying their data to the central, threefold knotty problem of methyl alcohol poisoning. This central problem is constituted of these subdivisions: (1) the cause of death, (2) the cause of blindness, and (3) the role of acidosis. Some writers in the past with more assurance than evidence have asserted that the characteristic acidosis is the cause of both death and blindness. That it is a contributing and perhaps chief cause of death is substantiated by the extremely low values for carbon dioxide combining power and by the authors' successes with alkali therapy. This is in line with the findings of Roe, of Berger et al., and others. However, the essayists are careful to state that adequate correction of acidosis in patients with severe methyl alcohol poisoning will not always save life or vision. This statement in regard to life is quite in keeping with what we know of acidosis from other causes. Patients in diabetic coma for more than twelve hours have only a 30 per cent chance of survival. However, the authors state that "if acidosis is severe or has persisted for several hours, death may result in spite of energetic treatment." If by several hours the authors really mean two hours or less, this is unlike other types of acidosis and should be noted. Detailed figures on time and severity of acidotic coma would be highly desirable here.

The question of the connection between acidosis and visual loss is an entirely different matter. Although they do not directly say so there are several points at which the authors seem to imply a causal relationship between acidosis and blindness. The temporary improvement in vision during the early phases of alkali therapy is curious, but its significance is contradicted by the authors' scatter diagram (fig. 4). Here there is indeed more visual loss in patients who had a more severe initial acidosis, but there are cases with measurable loss of vision and nearly normal carbon dioxide combining power. Among the more severe cases of acidosis it makes little difference whether the initial carbon dioxide was 4 mEq. per liter or three times that much; the proportion of blindness is roughly the same. Similarly in the cases described in detail there is no correlation between treatment and blindness. This is exactly what we would expect if acidosis and loss of vision were parallel manifestations of a basic toxic mechanism but had no cause and effect relationship with each other. Most significant of all, we must bear in mind that in acidosis from other sources, such as diabetes, visual loss is not characteristic. The diabetics who survive extended coma with carbon dioxide values every bit as low as those typical of methanol intoxication show no characteristic decrease in visual acuity.

Work in our own laboratory in Cleveland with whole animals and surviving tissues, using radioactive methanol as an indicator shows that methyl alcohol is chiefly metabolized in the liver and the gastrointestinal tract. Most of the labeled carbon fixed in tissues occurs in the liver. Since only at a site where a compound is fixed in tissue is it likely to exert its toxic effect, we have begun to think of methanol poisoning as primarily a disease of the liver. The acidosis is conceivably the result of a perverted metabolism of this organ. The idea is further substantiated by the paper of Van Slyke and Palmer describing an unidentified organic acid excreted in extremely high quantities by a methanol poisoned patient. There was collected some 4 liters of tenth normal acid in 48 hours and the acid was shown to be neither formic, lactic nor acetoacetic acid. Work is in progress on monkeys with a view to isolating this acid. The chemical identification of the acid should throw much additional light on the mechanism of acidosis.

One area in which we must emphatically disagree with the authors is their discussion of the biochemistry of methanol poisoning. The theory which they present, that methanol or a breakdown product combines with the "iron catalyst of the oxydase system," was devised by Roe on the basis of no direct experimental evidence. Actual experiments with surviving retina, reported by us (Potts, Albert M., and Johnson, Lorand V.: Studies in the visual toxicity of methanol. I. The effect of methanol and its degradation products on retinal metabolism, Am. J. Ophth. v. 35, part II: 107-113 [May] 1952) show that the cytochrome system is relatively insensitive even to formaldehyde, the most potent inhibitory breakdown product of methanol. The succinoxidase system, one of whose components is the cyto-

chrome-cytochrome oxidase system, is much less sensitive to formaldehyde than is glycolysis. Subsequent work, as yet unpublished, shows that the hexokinase system which phosphorylates glucose is the actual site of inhibition. Thus the chemical site of action is actually at the beginning not at the end of the metabolic cycle. There is no evidence that retinal hypoxia is a feature of methanol poisoning.

The caution of the authors about the use of experimental animals is well taken. Methanol poisoning is obviously not the same in experimental animals as it is in humans. One need only examine the lethal dose for rats as compared to humans to realize that in grams per kilogram of body weight the dose to kill a rat is some ten times higher than that for man and that on this weight basis methyl alcohol is no more toxic to a rat than ethyl alcohol. Actually one must be observing a narcotic type organic solvent poisoning in the rat and a specific metabolic product poisoning in the human—two very different effects. Nevertheless opportunities to observe human cases as numerous as this series come once in a lifetime, and when they come they must be instantaneously used to advantage or the opportunity is forever lost. What is more, the pressure to institute life-saving measures is so great that controlled experimentation is out of the question. For this reason the Western Reserve laboratory has made every effort to locate a suitable experimental test object. This effort is being prosecuted in several directions. With the help of the electroretinogram a survey of visual methanol toxicity in lower animals is being made with particular emphasis on cone retinas and mixed retinas and the utilization of lower primates. In addition human biopsy and autopsy material is being employed for in vitro work. It is hoped that by some such approach the necessity of waiting for disasters may be short-circuited.

When such an event as the one under consideration does occur, we are most fortunate if we have individuals like the authors available to seize the opportunity and make the most of it. I believe that they should be congratulated for their handling of the situation and for extracting from it the data presented here.

F. Phinizy Calhoun, Jr., M.D., Atlanta, Ga.: A catastrophe of this magnitude provides the chance of a lifetime to observe the acute and late eye manifestations of this condition. Dr. Benton was able to devote practically his full time to recording and evaluating the eye findings during the acute stages. The analyses given today, therefore, are the results of hundreds of eye examinations of these patients made during the acute and follow-up stages of the condition.

It may be worth while to mention the panic and terror which characterized the catastrophe. Among the consumers of so-called "alley" whiskey, hysteria mounted as news of the poisoning spread. The sidewalks outside the hospital became crowded day and night with worried relatives. The emergency clinic became swamped with victims, both real and otherwise, and some method of rapid screening of these patients became necessary. Although the commonest symptom was some disturbance of vision and the only useful physical signs in screening patients for treatment were the ophthalmoscopic findings of disc hyperemia and retinal edema, occasionally severely poisoned patients failed to show these changes. Fortunately there was at hand a new bedside method of determining the carbon dioxide combining power of the blood which required simple equipment and produced a highly accurate reading in a few minutes. This test then became a quick, reliable method of screening patients for treatment and of following therapy.

The actual poisoning agent and the significance of the acidosis in this condition are still unsettled problems. Although the acidosis may have nothing to do directly with the visual loss it remains a fact that in many cases, relief of symptoms with sodium bicarbonate therapy was prompt and satisfactory; with correction of acidosis, there was return of consciousness, disappearance of pain and nausea and improvement in subjective visual complaints. A few, however, despite return of the carbon dioxide combining power to normal remained comatose and died in a few days. It was the strong clinical impression that the massive alkalinization utilized in the treatment of this series of patients prevented a greater loss of life and vision than actually occurred.

Answering Dr. Potts' question, according to local newspaper accounts the offending bootlegger and plainly marked drum of methanol were soon found. The man was tried, convicted, sentenced to life, and is at present appealing for a retrial.

Figures of the time factors in the acidosis are given in the paper. We are well aware of Dr. Potts' recent beautiful work in this condition and believe that he is very close to a solution of the entire problem.

NEURINOMA OF THE ORBIT

(A Clinicopathologic Case Report)

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L. K., a 24-year-old white married female, was seen in the eye clinic of Michael Reese Hospital, November 28, 1950 because of proptosis, impaired ocular motility and visual loss of the left eye of several months' duration. There was no history of trauma, but a dull headache persisted above the left eye.

The ocular examination revealed a visual acuity of 20/15 in the right eye and 20/40 in the left eye. The left eye was proptosed. The exophthalmometer reading with a base line of 95, was 12 on the right and 22 on the left. Diplopia fields revealed an impairment in the field of action of the left internal rectus, left inferior and superior oblique muscles. The bulb could not be compressed into the orbit. The pupils were normal. Funduscopic examination revealed the right to be within normal limits. The left disc borders were poorly defined with the veins mildly dilated. The tension was 20 on the right and soft on the left. The peripheral fields were normal but the left central field revealed a slightly enlarged blind spot.

Because a retrobulbar tumor was suspected, the patient was hospitalized for further work-up. The laboratory examination revealed a basal metabolic rate of +7.7 per cent. The hematologic studies, including blood agglutinations, blood chemistry, and serology, were without significant findings. Roentgenograms of the sella, orbit, optic foramen and sinuses were noncontributory. An arteriogram, with radiopaque substance injected into the left carotid artery, revealed no abnormalities of the vascular tree.

On December 29, 1950, exploration of the orbit through the cranial approach by the neurosurgical department (Dr. Milton Tinsley) revealed a pinkish tan granular mass within the muscle cone adherent to the bulb nasally and above. The tumor was difficult to extract, and had to be removed piecemeal, some being left in the orbit. No extension through the optic foramen was visible.

The postoperative course was uneventful except for a moderate edema about the lids, and some diplopia in the lower fields. When seen nine months later, the visual acuity was 20/20 in each eye. Diplopia was no longer a complaint although 12$^{\Delta}$ of left hyperphoria was still present in the lower field. The exophthalmometer reading was 12 on the right and 16 on the left. The left fundus was clear with some traction striae above the macula.

Microscopically, the tumor was quite cellular, consisting of a solid mass of interlacing bundles and whorls of spindle-shaped cells with regular, elongated, oval, pale staining nuclei. There was a tendency toward palisade arrangement (figs. 1, 2 and 3). This is characteristic of the Antoni type A neurinoma in con-

From the Department of Opthalmology, Michael Reese Hospital.

Presented as a clinicopathologic case report at the Fifty-Sixth Annual Session of the American Academy of Ophthalmology and Otolaryngology, Oct. 14-19, 1951, Chicago, Ill.

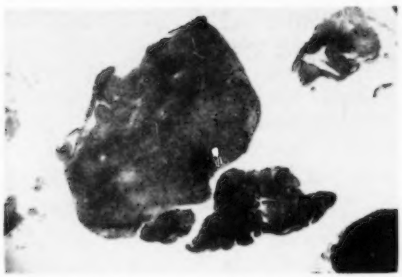

FIG. 1—General appearance of the tumor under low power.

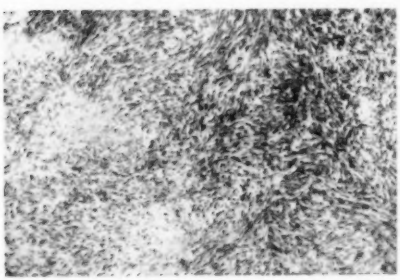

FIG. 2—Another view revealing the characteristic interlacing cords of spindle-shaped cells.

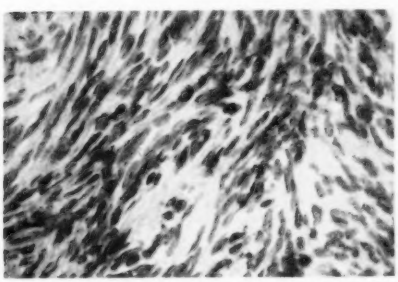

FIG. 3—High power view of the spindle-shaped cells and their nuclei. They resemble connective tissue cells.

tradistinction to the Antoni type B with loose areolar tissue and microcysts. Verocay bodies, cells and fibers which arrange themselves into units resembling tactile corpuscles, were not visible in the tumor mass.

COMMENT

The neurinoma, a benign and normally encapsulated tumor, is believed by most clinicians to originate from the Schwann cells. (Forrest,[2] Reese,[4] Duke-Elder.[1]) Thus, it can occur anywhere along the course of a peripheral, cranial or sympathetic nerve. Forrest, reporting on 222 tumors in the Registry of Ophthalmic Pathology of the Army Institute of Pathology, found 17 tumors related to the peripheral nerves. In only two cases was the herringbone arrangement a prominent feature. Ingalls[3] examined 216 orbital tumors in the pathologic laboratory of the Institute of Ophthalmology of Presbyterian Hospital and found only two cases that he could classify as neurinomas.

Although it was difficult to determine, the tumor in the case presented may have originated from the ciliary nerves. The eye manifestations of this tumor have no distinct clinical features, and have been reported in every age group.

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SECONDARY GLAUCOMA, CATARACT AND RETINAL DEGENERATION FOLLOWING RADIATION

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This is a report of an eye of a 5-year-old child wherein signs of inflammation developed following radiation. Previous to the radiation the eye had been perfectly normal to clinical examination. The eye was removed at the time of exenteration of the orbit for an orbital tumor.

The radiation was given because of a malignant orbital tumor. The first course of radiation delivered a tissue dose of 3,840 roentgens in the course of 27 days, which ended in July, 1948. Nine months later, when the orbital tumor recurred, there was no evidence of ocular disturbance. The second course of treatment was given beginning in April, 1949, and consisted of a tissue dose of 6,320 roentgens over a period of 33 days. The lid remained swollen following the reaction from the radiation and in the course of three months the eye showed injection, was painful and showed marked photophobia. The enucleation and the exenteration was done one year following the last course of radiation. The radiation was given because permission could not be obtained for the recommended exenteration.

The pathologic changes in this eye may be summarized as secondary glaucoma, corneal ulceration with vascularization and infiltration, cataract formation, retinal degeneration with cystic formation either in or near the macula and preretinal hemorrhage.

From The Wills Eye Hospital.

Presented as a clinicopathologic case report at the Fifty-Sixth Annual Session of the American Academy of Ophthalmology and Otolaryngology, Oct. 14-19, 1951, Chicago, Ill.

The pathologic report is as follows: Cornea—The epithelium is entirely absent except for short areas near the limbus. The cells of the stroma are reduced in number. Bowman's membrane is also absent over the greater part of the area.

The stroma shows loss of substance over the central areas with ulcer formation. There is marked infiltration of all the anterior layers of the stroma with vascularization. Practically all of the infiltration and vascularization is limited to the anterior half of the stroma. The infiltration consists chiefly of round cells with a few polymorphonuclear leukocytes and a moderate number of eosinophils. Descemet's membrane is present over the whole of the posterior corneal section. The endothelium is also present. The nuclei of the endothelial cells are flattened and are widely spaced. There are a few pigment deposits on the endothelium.

The anterior chamber is only slightly more shallow than normal. The angles on both sides are obliterated by an extensive anterior synechia. There are a number of cells in the false angle so formed, chiefly red cells with a few phagocytic cells. There is a moderate cellular infiltration of the iris, chiefly at its root. On one side the uveal layer has been displaced over on the anterior surface. There is a thin layer of fibroblasts on the iris surface. The ciliary body shows a minimal number of cells deposited on its surface.

The lens capsule is present over the whole of the lens but appears wrinkled. The capsular epithelium is present over

the usual areas. There are no layers of proliferating capsular cells at the equator. Subepithelial, granular deposits are present. Most of the lamellar structure of the lens has disappeared and throughout the lens there are a number of small vacuoles. Subcapsular changes are present both in the anterior and posterior areas, with more marked changes in the anterior area.

The posterior chamber is free of exudate. No areas of infiltration were noted in the sclera. The whole of the choroid appears unusually thin, which may be due to fixation. There are no areas of unusual vascularity or infiltration.

The retina is in contact with the choroid over all areas except for a small area adjacent to the disc on the side away from the macula. This separation is either serous or artefact in nature. The marked retinal changes are adjacent to the disc. These consist of retinal folds, disorganization of the layers and cyst formation, intraretinal homogeneous exudate, and preretinal hemorrhage on the surface. The pigment epithelial layer over a limited area shows signs of cell degeneration with pigment dispersal. The vitreous is not noteworthy except for a hemorrhage just anterior to the disc and over the adjacent retina. Some early proliferative changes appear to be present here.

The optic nerve shows no abnormal cupping. One vein in the section appears moderately dilated. The artery was not unusual.

In summary, a report has been made of an eye wherein extensive pathologic changes have occurred following radiation and wherein the changes can be attributed to the radiation.

FACIAL INJURIES: A SUMMARY OF OBSERVATIONS

JAMES BARRETT BROWN, M.D.
ST. LOUIS, MO
BY INVITATION

IF SEVERE facial injuries can be repaired soon after the accident, the best results are obtained and less secondary correction will be necessary. There are four reasons for not doing early operation; (1) too much general shock, (2) too much brain damage, (3) fractured cervical vertebra and (4) intoxication. In these instances operation is delayed.

[Slide] This patient had almost total destruction of soft tissues of the face with the conjunctiva torn away from the limbus. In consideration of severe soft tissue tearing of the face, it is thought that neither of two recommendations from World War I and World War II should be applied to such patients. One of these recommendations was to do a cutting débridement, which definitely should not be done; the other one was to pack the wound open, which should not be done. Neither of these recommendations need apply to the face, for the reason that gas gangrene does not develop in the face, which was the inciting factor in the promulgation of these two rules and most function and most features can be preserved by saving tissue. However, in injuries elsewhere (except in the hand) and especially in the lower extremities, these rules were found to be effective.

If we will go to the operating room at an early moment and are patient, we can sort out these tissues and put them back together, saving every possible millimeter. We may be able, as in the case of this patient, to restore the parts totally in just a single operative procedure. If either a cutting débridement or packing open of the wound had been done, possibly fifty operations would not have restored this patient to as nearly normal a condition as is shown from the one early operation. The tissues are actually débrided, but this is done by cleaning out foreign bodies, dirt and oil. Completely detached fragments are removed, but nothing that might live is cut away from the face. (These same rules of not cutting away and not packing open the face apply to the hand.)

In putting a severely torn face together after cleansing, the various flaps and parts are sorted out and returned to their normal positions. Closure is started at a known point, the border of the nose, the brow, the tarsal or the lip border. It is important to avoid putting in wide sutures, because if they are put in far from the wound margins, wide scars will result. We call these wide scars "ladder scars" and they cannot be eliminated satisfactorily. There may be no way of getting rid of them without excising too much tissue to allow of smooth closure.

One type of injury crashes open the face, actually chisels the eyes apart, and opens clear back to the ethmoid region, with displacement of the canthi. The correct position of a canthus that is badly displaced probably cannot be restored. One may get a correct level, but the proper depth is unattainable if there has been severe distortion and long fix-

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ation. The internal canthal ligaments are attached by several dozen tiny filaments to the crista lacrimalis and even the smallest sutures will not replace them very well. So our criterion is to bring the canthi back to where they came from, if we possibly can, before fixation of the fibrous tissue and infection have occurred. This is usually a simple procedure of elevation and molding together of the separated fragments.

[Slide] This child had been operated on under local anesthesia forty-five minutes after the accident. We usually pack the wound with a light topical anesthesia and then introduce the needles for deeper infiltration or block through the wound so that pain is reduced to a minimum; one cannot do these operations satisfactorily without adequate anesthesia. In some institutions an effort is made to close these wounds without any anesthesia, but in most cases such a procedure is not satisfactory.

In what can be called a complete fracture of the face there may be as many as seventy-five fractures at one time, with some little chips of bone no larger than a thumb nail. This results in a totally displaced and fractured face. [Slide] The patient was seen after ten days with her face one single plane from one ear clear over to the other, the nose crumpled in, both orbits down, dental arch loose, palate split, pyramidal fractures on both sides, septum crumpled and the lower jaw broken.

Sometimes the suggestion may be made, "Well, let's wait until after the swelling goes down and see if there is a fracture." An answer to such a suggestion can be, "Here is a steel automobile that is broken all to pieces. It looks like the face that went through the same accident ought to be fractured. Perhaps that is the reason it is so badly swollen." Sometimes in consultation there is apparently little concern or idea as to what to do about the badly shattered face it often being considered far secondary to the general condition or other injuries.

What do we have to do? Basically and philosophically we do the opposite of what the accident did. We pull the nose up out of the face. We get the canthi together; establish airways; bring the teeth together, so the jaws close and occlude. Those are the three main functions of the face—protection of the eyes by the lids, open airways to breathe through and teeth together so they can chew.

A fourth function of the face is to look normal so that the patient may have a chance at a normal social, educational, economic and marital life, so that in addition to the three basic, physiologic approaches to the problem, the fourth problem is to try to get the face to look like it should, i.e., to reproduce the normal "contour anatomy," a term we have used to describe the effect of normal surface structures.

[Slide] The child illustrated had had her nose, orbits and whole middle third of the face simply "mulched" forward. This term is used for want of a better one and indicates that the multiple fragments have been saved and carried into place and held without loss of structure, her airway has been aligned and re-established as well as possible. We have pulled the nose up out of the face, have collapsed the jaw itself toward the midline, and actually have just mulched the front of the face forward, with packing inside the antrum to hold it. There would be nowhere to put an overhead splint on this girl with a badly shattered face which is so wholly detached and displaced, like an egg dropped on the floor. Her nose, as shown in the first slide, is held on by two wires from side to side. The result has been obtained in one single operative procedure.

An important thing for consideration is the relation of bone and soft tissue in-

juries. As shown in these two patients, one had a totally shattered face as far as bone is concerned with very little soft tissue injury, whereas the first patient had her face totally disrupted from soft tissue injury but had no bone injury. But it happens that injuries of both bone and soft tissue very often go together; for this reason it is thought that one should not make any rule to wait ten days before repairing facial injuries. We think the surgeons should get to the operating room and do the repair soon after the injury if he possibly can. That does not mean that he should not repair the injuries if seen late, but the advantage of early operation can be vouched for by practically every house officer who has observed patients under both early and late treatment. One interesting and important thing about these facial injuries is that we are all candidates for them.

FIG. 1.—Extensive crushing injury and soft tissue damage in farm accident. There was not much stable bone left and practically no shape to the nose, which was torn loose and inverted into the face. Operation was performed within 12 hours under intratracheal anesthesia. The reverse of what the accident did was carried out in "unfolding" the nose and face, elevating the left orbit, and fixing the parts with cross wires and aluminum splint for the nose and with one internal wire for the shattered pyramidal fracture and left zygomatic displacement. X-ray film shows pin in place and the zygoma restored, along with the orbital border. The left eyelid is torn completely open so that the eye looks through the rent. This case is an excellent example of the necessity of early operation. To wait ten days, as has been advised elsewhere, would result in possible eye damage and need of multiple operation. This patient has had full restoration and rehabilitation in the one operation. No further work is necessary.

Internal wire fixation in fractures of the upper jaw has been used by us for several years as an outgrowth of use in the lower jaw.[1,2] The patient in the accompanying photographs (fig. 1) had a combination of soft tissue tearing and bone disruption. His left eye could look right through his torn lid. His nose was completely flattened and his face was badly injured. One internal wire was placed across the middle third of the face from the sound zygoma on through to hold up the fractured left side. The wire pin acted as a cantilever support, having a solid fixation on the solid side and coming right through the face and picking up the fractured side after it had been replaced. If correct replacement cannot be done, of course, there is no reason for putting the wire in place.

[A slide showed the orbital border with the orbit about a centimeter longer.] Diplopia may occur if the border goes back or down into the antrum allowing the globe and orbital fat to follow. Good restoration of the comparative heights of the orbits may be obtained by placing a wire across from the solid portion on one side through the replaced loose portion. An x-ray following surgery on the patient shown in the slide mentioned above is interesting in that the patient's antrum had already become aerated.

The final result was achieved in a single operation, with the four elements of function restored: (1) closure of the lid to protect the eye, (2) dental occlusion for chewing, (3) patency of nasal passages for breathing, and (4) restoration of normal contour anatomy of the face.

Another severe injury to bone and soft tissue cared for by Dr. Fryer had two wires placed through and through so that the nose was resting on them (fig. 2). The complete result was obtained in a single-stage procedure—the nose pulled up out of the face, the jaw put where it belonged, the teeth occluded and the soft tissues closed. In all of these bad facial droopings or elongations, we try to be sure that the sclera shows equally under the cornea on both sides. Sometimes due to some slight paralysis or to some slight drooping, a little extra sclera may show.

Attention can be called to one more thing about faces that has not been mentioned — we have been talking about traffic accidents in which the tissues are usually just displaced, but when dealing with other accidents such as gunshot injuries, there is the added difficulty that some of the tissues have been blown away. The patients previously described have simply had displaced tissue; but when tissue is destroyed, more tissue has to be added to the area to obtain acceptable repair.

A free graft, which we have called the composite graft, from the ear is one of the most useful forms of tissue replacement on the face. It is a total replacement of the ala of the nose by a free graft from the ear consisting of two surfaces of skin and the intervening cartilage. The repair is done in a one-stage procedure. This procedure in the replacement of lost tissue gives much better and more normal looking nostrils than heavy flaps brought in from a distance.

In any free graft one has to get back to an adequate minute blood supply in opening the scar. If this is not done, a free graft will not grow. There can be free blood all over the wound but it must be opened up to an adequate minute blood supply. A pattern of the nasal defect is taken from the ear with two surfaces of skin and intervening cartilage. The ear is either repaired directly or slipped under a scalp flap and brought out later, repairing the ear defect with tissue that was behind the ear.

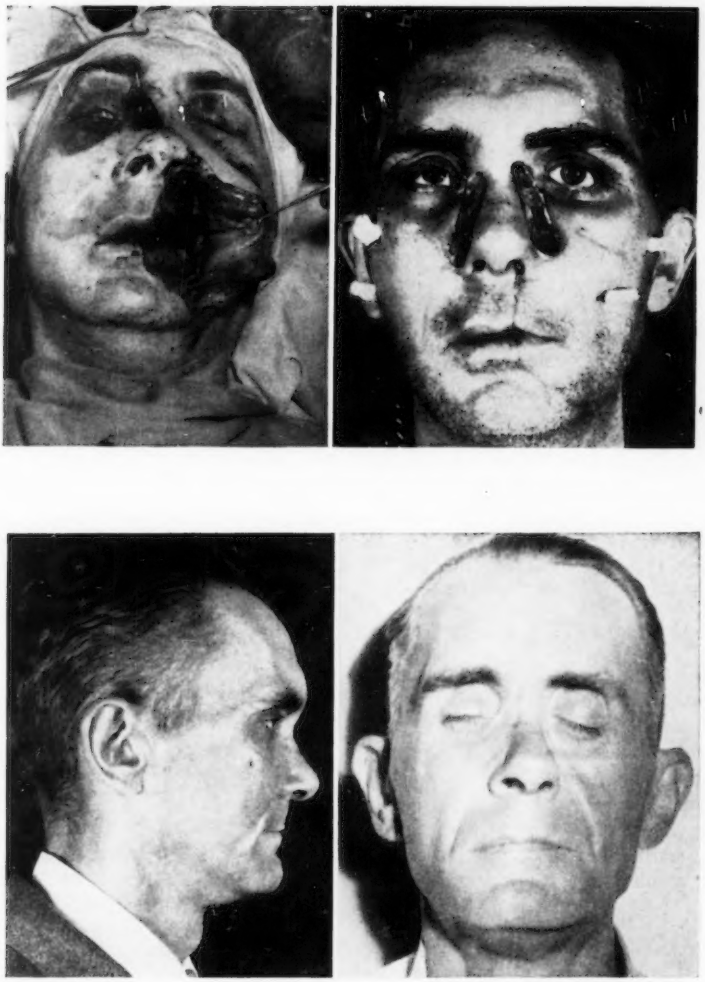

FIG. 2.—Complete shattering and widespread avulsion in driver found unconscious at side of road. Operation was performed within 12 hours after clearance of neurosurgical consultants. Bones were shattered into many small fragments and the mass was "mulched" forward and held with cross wires for nose, direct wiring of zygoma, and frontal distention and gauze splinting of antra. The internal wires across shattered fragments on both sides were used for stabilization. Closure avulsion of soft parts was affected. Patient is shown with internal wires through face. Patient out of hospital with cross wires holding nose. Only one operation was necessary.

This method was developed at Valley Forge Army Hospital and has been adapted in civilian life. A child who had been injured by a sled runner across her face, had her nose wadded up to practically nothing. Her nostril was restored with a composite graft from the ear, a single-stage procedure, resulting in a normal appearance of the border.

The seventh nerve is of deep concern for these patients in relation to the normal expression of emotions, to normal chewing, to a normal socio-economic life which in turn is dependent on normal contour anatomy. All patients with facial paralysis who come to us have been passed on either by a nose and throat service or by a neurological service which does or does not wish to do something with the nerve. When they do not operate, we take fascia lata from the leg, support the paralyzed face with it by transferring motion and support to the face from the lost seventh to the fifth nerve which supplies the temporal muscle.

Since our first publication in 1938, we have felt that this is the most satisfactory way of doing the substitution. There seems to be no reason for using metal wires when fascia lata is so easily accessible. Sometimes closure of the eyes may be achieved.

A girl with a paralyzed face was shown with what was thought to be a good result. She has developed a nasal labial fold by a slight setting of the temporal muscle and gets a good deal of emotional expression, using the fifth nerve masseter for the seventh nerve facial muscle. It is important to have these patients appear somewhat glum on the unaffected side, and they are cautioned not to overact. If one tells this girl a joke or sticks a pin in her, she will overact on this side still. This child was chosen beauty queen in her high school, even though her face was still paralyzed. She has learned to substitute the fifth nerve temporal muscle "hook up" for the lost seventh nerve action.

[The method of putting in the fascial loops and utilizing the temporal muscle and the fifth nerve was illustrated.] We may not get emotional expression but we can get enough support to help the patient adjust, and the ability to chew is facilitated. Even if nerve work is going to be done, the face can be supported while the nerve is regenerating.

In the consideration of correction of a late nasal deformity, it is important to know whether it has occurred from disease or from a childhood injury. If we can determine, for instance, in a person with practically no nasal bridge that he has not had a septal abscess and that nobody has taken out any bone, sometimes we can find that bone still present in the face. By going down into the face, what is left of the bone may be loosened along the frontal processes of the maxilla and may be actually brought up out of the face. This necessitates refracturing the bone with chisels or saws. It is not to be recommended too highly, but in some instances it can be done. The operation recreates the first fracture, one might say, and we are still reversing what was done in the accident.

One type of deformity which comes from either early or late fractures, should be corrected. The nose is completely out of alignment. One of the generals in the Army with a nose like that flew over to us from China during the war. His nose was repositioned and he went back to his theater of action. These are not considered "sissy" operations. One has to have function through the nose, but one also has to look fairly normal.

It is also important to decide, when one cannot find enough support for the nose, what can be put in to support it. Many substances have been used, but theoretically the best thing is the pa-

tient's own bone or cartilage. However, autogenous fresh cartilage is likely to distort badly and the repair may have to be done again. Often the repair work has been well done, but the cartilage seems to curl too much in many instances. This difficulty might be avoided by using bone. Preserved cartilage may not last forever. It may come in two, but after the nose is once lined up, it is not too much trouble to change the support if it becomes necessary. Bone transplants are certainly not free from the danger of absorption and many patients do not want to go through the second procedure of setting the bone graft, but they at least do not curl.

Cartilage from animals has not been observed and recorded in a sufficient number of successful instances to warrant full dependence on it at present, but experimental work is being carried out with it.

Artificial subcutaneous prostheses for the nose have not been observed over a sufficient number of years, but a prosthesis which proved permanently satisfactory would be one of the greatest helps to this type of reconstructive surgery. We are doing experimental work on polyvinyl compounds at present.

One thing worthy of note is that the septum seems to be an important part of the nose despite the teaching that it is unimportant as a support and the apparent lack of concern that is occasionally seen in resections of it. It seems evident that a normal nose cannot be pushed flat down on the face because the septum is there. Some have said that the septum does not make any difference in the lower part of the nose, and so it may not, perhaps, if one considers luetic deformities in which there has been a loss of lining and the nose has been pulled up. And it may not make much difference if one has a heavy alar cartilage. However, many patients have been seen who have had their septums resected who have dorsal defects and the tips of their noses could be flattened against their faces. We have never seen a patient who liked to have a nose one could do that to, i.e., push the tip right down on the face. So in these instances, where the deviated septum has been taken out and thrown away and a deformed nose has resulted, we believe the depressed dorsum should be supported. It can be supported with any subcutaneous prosthesis one chooses to use. A patient shown had her septum replaced with preserved cartilage, and her nose could no longer be pushed down on her lip.

Nasal deformity often results from an early childhood fracture. Almost all children have fallen. Almost all of them have broken their noses whether they know it or not, and in perhaps some of them the cartilage is torn loose, so that the injury may come very early in life and not show up until around puberty. We do not see any reason whatever for not correcting the result of this damage of the nose at a later date whenever the patient wants it done. If the patient had had a normal nose at this age and had had it laid over under one eye, he would have come in and have had it put back where it belonged, and, therefore, we see no reason for not bringing it back up where it belongs even though the injury occurred early in life. It has been pointed out that even in the process of birth the damage may occur.

Similar considerations for operation apply to racial characteristics of noses. Jewish noses especially can be more noticeable and more pronounced because of fractures in early childhood. There is no reason, as far as we can see, for not trying to establish normal contour anatomy.

Everyone is conscious of the fact that burns occasion a great deal of discussion on all surgical services and in the National Research Council and in the military service. In the last war at one

time we had 11,000 patients in plastic surgery centers, and one third of the work was taking care of facial burns and restoring lost skin so features could be put where they belonged and normal function and normal contour anatomy could result. Unfortunately, the statement has been made that it does not make much difference what is done for a burned face as they all heal up. This is usually true, but if the full thickness of the skin is burned through, there will be scarring and distortion so that the four functions of the face will be lost. The real problem, from a plastic surgical standpoint, is the deep burn of the face, not the superficial burn. These will heal as well as superficial burns elsewhere on the body.

[A slide illustrating a typical Air Force burn was shown.] Burns like this occur to civilians, also, or they can happen to anybody who is exposed to hot fire over a long period. This patient lost all of his eyelids. His eyes under them were unharmed but they do not show and cannot see because the lids are tightly closed by scar. What is the problem? The problem is to do the opposite of what the burn did. Take out the scar. Restore the tissues as close as possible to their normal positions and then graft in what skin has been lost. This man has had all four eyelids restored, plus his eyebrows and ears, and his hands have been entirely grafted. He can open and close his eyes. He has had the dense scar removed from all four canthal regions, with free full-thickness skin grafts put in.

We might ask why free-skin grafts are used so much. It is important that free grafts should be used wherever possible in facial burns instead of flaps, unless a whole feature such as a nose has to be replaced. Free grafts allow the best contour and most natural surface and permit of some emotional expression, whereas a flap is bulky, gets fat on any increase in weight and does not allow freedom to express emotion. Tribute should be paid to these severely burned patients, many of whom have war injuries. Their own effort in their rehabilitation is an inspiring compensation for work done with them.

In gunshot injuries extensive loss of tissue always occurs, so this type of facial injury is very important to the plastic surgeon. One soldier had total loss of the jaw from angle to angle and of the overlying soft tissues of the lower third of the face with his tongue hanging down on his neck. The plastic surgeon has to build backward in contrast to the usual concept of construction. In a building or most anything else one would put the support in first and then hang the outside on it, but the surgeon has to reconstruct the outside first and then put in support, something like erection of a tent rather than a solid building. A flap was brought up from below and a bone graft of the entire body of the jaw was put in after the flap was in place. This man's life was saved originally by the echelons of surgeons and nurses and dentists being up front where he could have early care. He has a new face, designed with a turned-in pocket to line the inside of his mouth. It is brought up in one stage, after preparation in two stages, and put in place. The donor site on the chest is closed at the same time, requiring at least two operating teams. On the first x-ray no jaw was seen from angle to angle. The last x-ray showed the full body from ramus to ramus of the jaw grafted in one single operative procedure after the flap had been put in. The bone graft of the full thickness of a rib is put into the covering flap secondarily. The patient now has a watertight mouth, the saliva going down instead of out. He has made his own adjustments toward rehabilitation following these efforts.

There are several important points about overhead traction of the jaw. The fractured upper jaw does not always hang down. If the blow comes from below, such as when the upper teeth strike the steering wheel, the antrum, which is the basic support, crumples upward, and in those instances the upper jaw needs to be pulled down in place if it has stuck up there, and should not be pulled upward to a further degree. Elevation of the upper jaw most of the time can be obtained in about thirty seconds with enough elastic traction from the vertex to the chin. If it will not come up, there is probably a piece of bone blocking it or the fragments are fixed with scar. Of course, it may be too late to get it up. One of our patients was a doctor whose face was severely crushed. His nose was pulled back into position, his teeth put back together and the upper jaw swung from the chin to the vertex, using the lower dental arch against the upper. This is a simple method, but it is effective in many instances.

A complicated overhead traction had been used elsewhere on a patient with a middle third separation, with the idea that the jaw had to be pulled up. The dental arch may have needed to come up a little, but it was pulled too far up by the overhead traction so that the walls of the antrum passed by themselves. The result after several months was that the patient had to have an extra set of teeth to wear over his own set. A plate was used over his own upper teeth. The middle third of his face has been so shortened by the excess overhead traction and has become so tightly fixed that it is a permanent deformity. The patient did have some surgical restoration, with revision of scars and rebuilding of the nose.

It is not recommended to try to break up one of these faces that has had about seventy-five fractures after it has been fixed for several months. In these patients seen long after the accident it is not uniformly possible to take a chisel, reproduce the fracture and get the face back where it should be, at least this has been our observation. Some readjustments and improvements might be made, but results cannot be obtained comparable with those that can be produced by early operation before permanent fixation has occurred.

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HISTOPLASMOSIS

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HISTOPLASMOSIS, a true fungus disease involving the formation of spores, resembles visceral leishmaniasis, in that the causative organisms are similar and both attack the entire reticuloendothelial tissue.

The reticuloendothelial system is composed of cells which may be demonstrated by their phagocytic action upon dyes which have been injected into the body. These cells are found in the connective tissue, lymph and hemolymph glands, spleen, bone marrow, and the stellate Kupffer cells of the liver. The reticuloendothelial system deals with the formation of bile, blood cells, antibodies, phagocytic destruction of blood cells and the metabolism of iron and pigments.

Darling,[3] in 1906, in examining smears from a case in Panama, found unusual oval or round bodies which he supposed were protozoa. He suggested the name of Histoplasma capsulatum for those organisms.

In order to clarify some doubtful points in the diagnosis of tuberculosis from roentgenograms, a study by De-Monbreun[4] at the Vanderbilt University School of Medicine, in 1934, first demonstrated, through cultures and transmissive experiments, Histoplasma capsulatum as the causative organism of histoplasmosis.

Etiology

Histoplasma capsulatum, a small yeastlike oval fungus, two to five microns in diameter, is the pathogen in the disease histoplasmosis (fig. 1).

From the Departments of Otolaryngology and Pediatrics, Vanderbilt University School of Medicine. Presented at the Fifty-Sixth Annual Session of the American Academy of Ophthalmology and Otolaryngology, Oct. 14-19, 1951, Chicago, Ill.

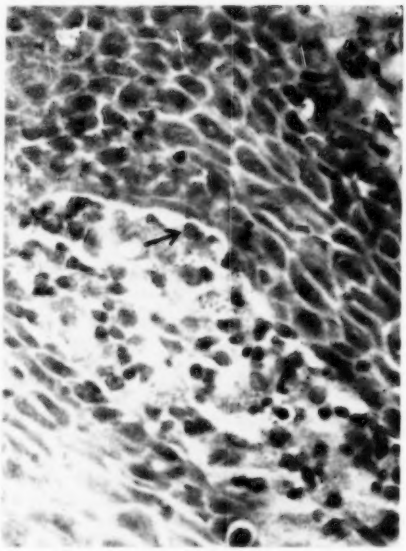

FIG. 1—High magnification of a granulomatous lesion. Arrow points to a typical group of organisms within a large mononuclear cell.

Because animals and fowls have been found to be infected with Histoplasma capsulatum there is a valid basis for the premise that they, particularly the domesticated group, may be the carriers in this disease. Studies to substantiate this probability are being made at this time. As yet unpublished research reveals one instance in which Histoplasma capsulatum is a saprophyte in the soil of a chicken yard. If the supposition of the animals and fowls as carriers proves to be correct it may explain, at least in part, the geographical distribution of histoplasmosis.

Histoplasma capsulatum produces, in general, two distinct types of growth:

1. It can be grown on practically any media at room temperature. The grow-

ing fungus in forming branching hyphae develops into a dense mycelium, similar in character to an intertwined mass of vines, producing chlamydospores. The growth is cottony white with an underlying yellowish cast, somewhat similar in appearance to that of a culture of Staphylococcus albus.

2. When found in tissues or when incubated on media, the growth develops as an oval fungus with a thick, gelatin-like capsule. Penicillin and streptomycin added to the media inhibit secondary bacterial growth and stimulate the development of Histoplasma capsulatum.

Although a period of thirty days following the culturing of the organism may elapse before the growth is seen, evidence of the fungus commonly is seen in forty-eight hours.

During the early cultural growth, the differentiation between Histoplasma capsulatum and Blastomyces is impossible. Slowly, however, at room temperature, Histoplasma capsulatum reaches its asexual stage and tuberculate chlamydospores are formed. At this stage the identity of Histoplasma capsulatum, with its Teutonic club-shaped spores, is evident microscopically.

Geographic Distribution

The geographic distribution of histoplasmosis has been determined by the presence of the disease and by results of histoplasmin skin tests.

A definite relationship exists between the incidence of histoplasmosis and areas in which calcifications of the lung are commonly seen.

Christie,[1,2] by intensive clinical and research work, has added greatly to our knowledge of histoplasmosis. He states, "Our studies have shown that 87 per cent of Tennessee residents with calcifications of the lung react to Histoplasmin, although such sensitivity is only

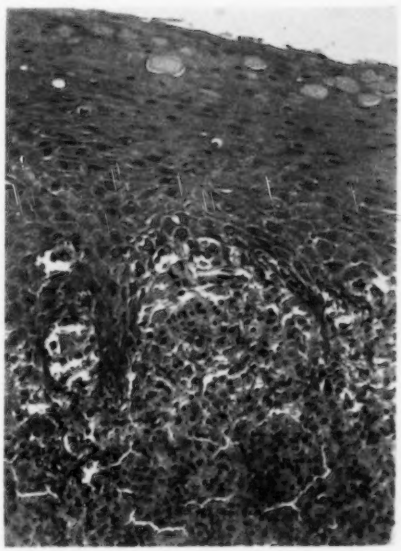

FIG. 2—Section of a tongue with intact epithelium showing a granulomatous lesion.

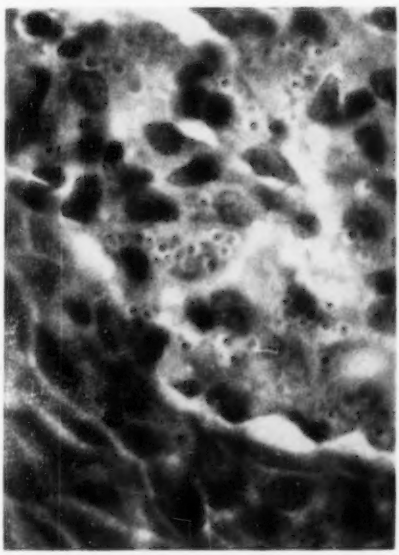

FIG. 3—Notice the halo around the organisms which is typical with high magnification in hematoxylin and eosin stained sections.

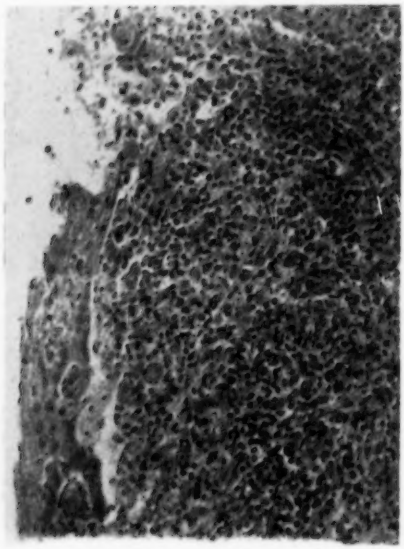

FIG. 4.—Ulcer of tongue with surrounding mononuclear cells.

half that common in those not having calcifications. Only 18.8 per cent of those with calcifications react to tuberculin, while 18.6 per cent of the group as a whole" (those with or without calcification), "react to this antigen."

Careful study shows that this disease is seen more frequently in this country along the basin of the Mississippi River and its tributaries.

Skin Tests with Histoplasmin

Emmons, Olson and Eldridge[5] prepare their antigen or histoplasmin by growing the culture from two to seven months on a synthetic broth medium. Christie[1] also prepares his antigen from a culture grown in a broth medium. This medium is similar to that used to produce tuberculin.

A 1:500 dilution is injected intradermally. A positive test is indicated by an indurated area of over 5 mm. in diameter when read within forty-eight to seventy-two hours.

Positive reactions are rarely obtained in the acute stage of the disease or in very young people, being more commonly seen after the first decade of life.

Cross reactions with blastomycosis and coccidioidomycosis have been reported in the literature but they have been more commonly seen in animal experiments.

Pathology

Ulcerations of the mucosa of the nose, pharynx, tongue and larynx are frequently seen as the primary lesions (figs. 2, 3 and 4).

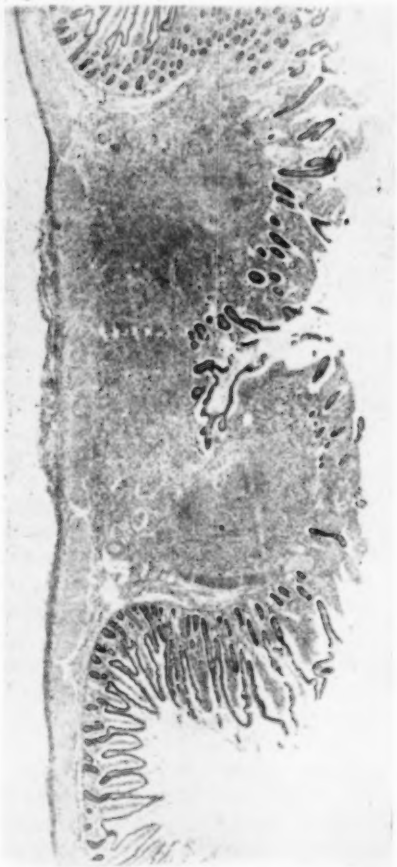

FIG. 5.—Granulomatous lesion of the gut in disseminated histoplasmosis.

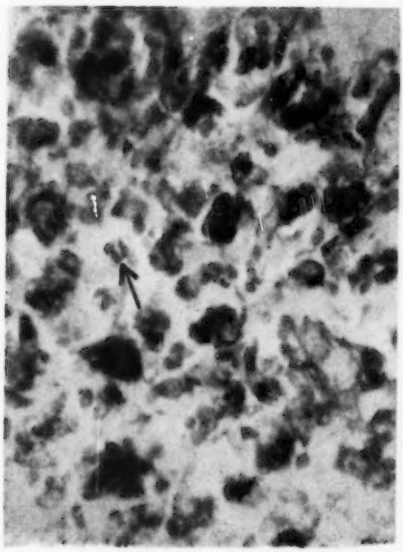

FIG. 6—Gut lesion. Hotchkiss-McManus periodic acid stain. Arrow indicates organisms.

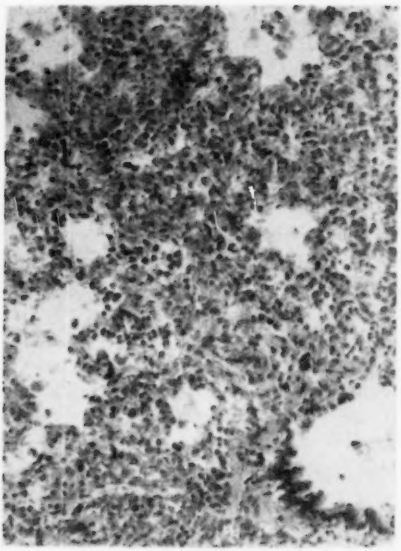

FIG. 8—Interstitial infiltration of the lung.

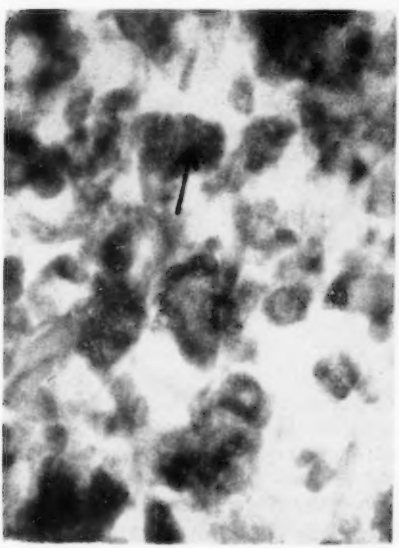

FIG. 7—Higher magnification of figure 6 revealing the staining of the capsule of the organisms, obscuring the internal structure.

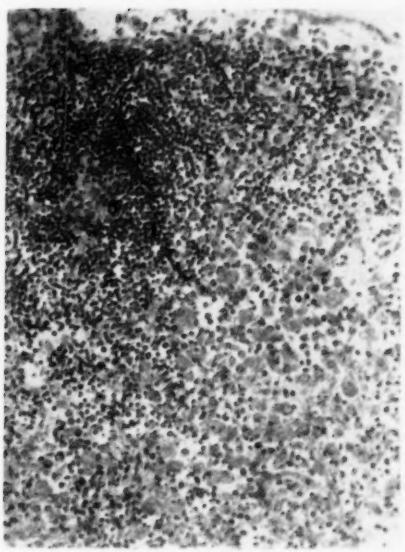

FIG. 9—Lymph node of disseminated histoplasmosis. Arrow indicates a persistine lymphoid nodule and the adjacent sinusoids are packed with large mononuclear cells containing organisms.

Microscopically, tubercles characterized by chronic inflammatory changes with granulomas, lymphocytes and numerous multinuclear giant cells revealing marked phagocytic action may be found in the lungs, adrenals, liver, spleen, lymph nodes, kidneys, intestines and bone marrow (figs. 5 to 9).

Leukopenia is commonly seen with the white blood count ranging from 6,000 to 1,600 or less. Lymphocytes may predominate. The hemoglobin may be as low as 35 per cent with a great reduction in the erythrocytes. The loss of hemoglobin has been ascribed to the loss of red blood cells and to hypochromic anemia of the normocytic and microcytic types.

CASE REPORT

A case which illustrated lesions of the upper respiratory tract, was that of a male, from another state. He was 48 years of age and had complained for eighteen months of hoarseness, weakness, loss of weight and appetite. He had noted two masses on the left margin of his tongue, one anteriorly and the other just in front of the anterior pillar of the tonsil. His local physician had made a diagnosis and was treating him, following a biopsy from the tongue, for carcinoma.

The masses were firm, round growths approximately 1 cm. in diameter protruding from the tongue margin ½ cm. A whitish area 4 mm. by 5 mm. was noted on the lower gum, having the appearance of leukoplakia. Superficial lesions were observed on the inferior surface of the tongue.

An examination of the larynx revealed several small nodules on the epiglottis and swelling of the left laryngeal false cord. The true cords had irregular margins. The entire larynx was a dirty white color overlaid with superficial blood vessels. A diagnosis of histoplasmosis was made from the tissue removed from the masses on the tongue.

The patient was treated with terramycin and general supportive measures. Three months later when he was re-examined, the granuloma located anteriorly on the tongue had receded, while the posterior granuloma had ulcerated with a necrotic crateral center. The ulceration was much larger than the original mass. A superficial ulceration of the left tonsil was present. The first lower bicuspid had been removed recently and the socket had ulcerated. Other ulcerations, grayish in color, were noted on the inferior surface of the tongue and the upper gum. The uvula was edematous with several submucosal abscesses. An examination of the larynx showed that the granulomas of the epiglottis were larger, the swelling of the left false laryngeal cord had increased and the serrated edges of the true cords were unchanged. There was thickening of the interarytenoid space, and the entire larynx appeared more blanched. The patient's constitutional symptoms were more marked.

Additional therapeutic measures were instituted, the results of which have not been determined at this time.

Ethyl vanillate, which will be discussed under "Treatment," has not been used in this case because of its potential toxicity.

Clinical Manifestations

In general, symptoms such as loss of weight, fever, anemia, anorexia, weakness, leukopenia and lymphadenopathy will be manifested. The following specific symptoms and physical findings may be noted: headache, ulcerations of any or all areas of the upper respiratory tract, miliary lesions, cavitation and calcification of the lung, night sweats, hoarseness, productive cough, middle ear infections, endocarditis, ulcerations of the intestinal tract, splenomegaly and hepatomegaly, papular lesions and joint diseases.

Differential Diagnosis

Histoplasmosis is a great simulator of many diseases. In general, one should differentiate histoplasmosis from tuberculosis, carcinoma, syphilis and fungus diseases.

Diagnosis. A diagnosis can be made tentatively with skin tests of histoplasmin and the complement-fixation test, and positively from biopsies, smears and cultures when the pathognomonic tuberculate chlamydospores are produced (fig. 10). Diagnosis is not possible from a physical examination. The organism is found intracellularly unless ulceration with necrosis is present,

FIG. 10—The characteristic tuberculate chlamydospore of histoplasmosis.

therefore, a negative report in smears and cultures from the sputum and gastric washings is of little significance.

Prognosis

Although actual statistics are not available, histoplasmosis of the fulminating type has a high mortality. Recent therapeutic advances may offer an improved outlook.

In the benign or asymptomatic cases the morbidity and mortality rates are low. Studies of the length of life in

these cases are inconclusive because the disease has been recognized only since 1934.

Treatment

Benign histoplasmosis. Potassium iodide is given in massive doses according to age. If it is not well tolerated sodium iodide can be given intravenously.

Disseminated histoplasmosis. Ethyl vanillate, a drug derived from wood pulp, may prove to be the drug of choice in histoplasmosis, particularly if the severe toxic reactions can be eliminated or controlled. This drug is antifungicidal as it is effective in the treatment of tinea and will kill some fungi in vitro in a dilution of 10 milligrams per cubic centimeter.

The initial dose of ethyl vanillate for histoplasmosis, given by mouth, is 0.5 gram per kilogram of body weight in twenty-four hours, given in divided doses in capsules.

The blood level of ethyl vanillate should be maintained between 10 mg. per cent and 50 mg. per cent per cubic centimeter. Below 10 mg. per cent per cubic centimeter it is ineffectual while above 50 mg. per cent per cubic centimeter it may damage the liver and kidneys. Death has resulted from its use, therefore, it is imperative that the correct dosage be maintained. Determinations of the blood level should be made at least daily. Since this drug has proved to be highly toxic, particularly to adults, in spite of the frequent determinations of the blood levels, it is the essayist's[6] opinion that ethyl vanillate should be used only in severe and critical cases. Its use requires hospitalization.

General care. Symptomatic treatment, including supportive measures as indicated by the clinical and laboratory examinations, is administered. Accessible ulcerations are cleaned and painted daily with metacresylacetate (cresatin) or gentian violet.

There is no proof that any of the antibiotics are of value in the treatment of histoplasmosis. On the contrary, penicillin and streptomycin may be contraindicated because they stimulate the growth of Histoplasma capsulatum when added to a culture medium.

Many drugs, too numerous to mention, have been used unsuccessfully.

SUMMARY

1. Histoplasmosis is a "new" medical disease which requires particular emphasis on diagnosis because it is similar to tuberculosis and syphilis in being able to assume the characteristics of many diseases.

2. It is a true fungus disease.

3. There is a definite relation between histoplasmosis and cases with calcification of the lung.

4. Cultures at room temperature produce diagnostic chlamydospores.

5. Benign cases may remain asymptomatic.

6. Acute histoplasmosis has a high mortality rate. Treatment has not been satisfactory to date. However, progress is being made in this important phase of the disease.

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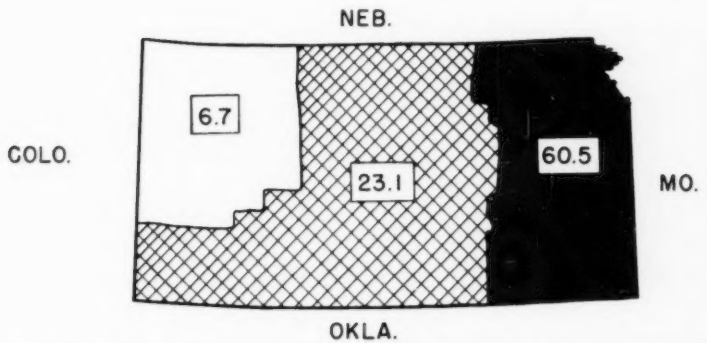
DISCUSSION

DEAN M. LIERLE, M.D., Iowa City, Iowa: About a year ago Carr and I reported four cases of histoplasmosis that have been seen at the University of Iowa during the preceding two years. All were adults and all died. One was treated with ethyl vanillate. One of the cases had two eroding ulcerative lesions of the tongue. There was also involvement of the larynx. The mucous membrane was generally pale and edematous and one could not distinguish between the false and true cords, the normal landmarks being obscured. The larynx was tubular in appearance with some obstruction to the airway. There was an irregular cauliflower pale mass about 1.5 by 1 cm. in size involving the intra-arytenoid space and extended into the chink of the glottis. The patient had some difficulty in swallowing and a pharyngoscopy revealed a definite stricture at the level of the cricopharyngeus.

Dr. Wilkerson's paper is timely. It is my opinion that the disease occurs much more frequently than we suspect and, in view of the fact that lesions of the lung resemble particularly those in tuberculosis and syphilis, there is a chance that some cases of histoplasmosis have been missed. The otolaryngologist can be of help in the diagnosis by recognizing the ulcerative lesions of the mucous membranes of the respiratory and digestive tracts. Organisms have been found in the purulent discharge of the middle ear.

Paran and Zarafonetis reported 14 cases of ulceration of the tongue. Other lesions reported involved the mucous membrane of the septum with perforation later and eventually saddle back deformity of the nose. Lymphadenopathy was present in 29 out of 61 cases. I wish to thank Dr. Wilkerson for the privilege of discussing his most interesting paper.



PERCENTAGE OF POSITIVE HISTOPLASMIN REACTORS AMONG 3600 KANSAS UNIVERSITY STUDENTS— LIFE TIME RESIDENTS OF AREA.

FIGURE A.

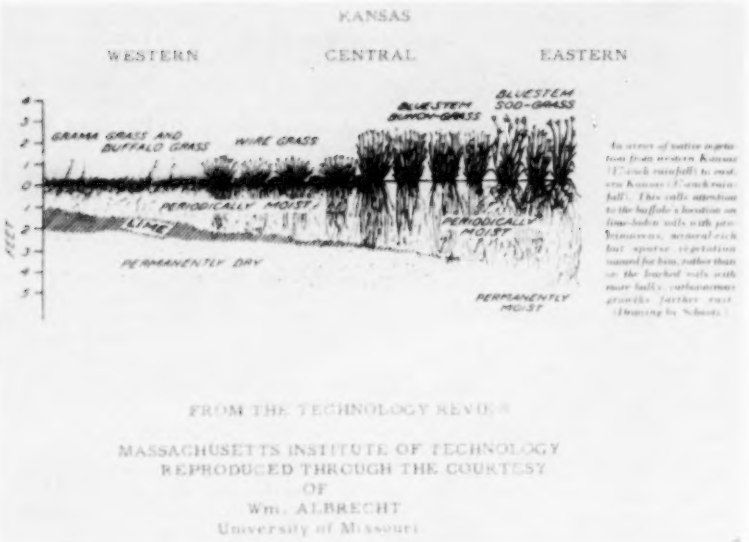


FIGURE B.

SAM E. ROBERTS, M.D., Kansas City, Mo.: I want to thank Dr. Wilkerson for bringing histoplasmosis to the Academy. I would, however, have been much more grateful had he brought it here two years ago. He would have saved me embarrassment and a marked vasodilatation of my face when my resident presented me with two cases of histoplasmosis of the larynx both of which I diagnosed incorrectly. After I had made these bad diagnoses, I did a little investigation on the campus of the University of Kansas Medical Center and found much to my surprise there had been some rather extensive geographic studies made. The first was made on 3,600 University of Kansas students.

At the time I reported two cases of histoplasmosis of the larynx before the American Broncho-Esophagological Association last year I could find but 15 cases in the literature. There have been several reported since this time. I missed the diagnosis on both of these patients because I did not consider the possibility of histoplasmosis. I had not proceeded far with my investigation of histoplasmosis until I discovered some very interesting facts.

We have on our campus at the University of Kansas a division of the United States Public Health Service in charge of Dr. Michael Furolow. I found he had made some extensive investigations as to the geographic distribution of this disease in Kansas (fig. A). I was profoundly impressed with the wide variations of the incidence of the disease; west to east—6.7 per cent to 60.5 per cent.

I had known for years of the work done by William Albrecht, Professor of Soils, at the University of Missouri (fig. B). His investigations showed a varying of native vegetations, especially grasses. You will note that the incidence of histoplasmosis increases as the lime and, of course, other elements recede into the earth beyond the reach of plant roots. It will be seen that in the western third of Kansas the lime and other elements come within one foot of the surface of the ground. The rainfall is only 17 inches per year. On this soil a gamma grass is grown on which American buffalo grazed many years. The buffalo seldom migrated eastward. There were no fences to stop him. This gamma, or buffalo grass, is short, highly proteinaceous, loaded with minerals and trace elements. This was what the buffalo, with true animal instinct, knew was needed for his big bones and a fine body. The wheat grown in this area is famous Kansas hard wheat for which millers pay premiums. Advancing eastward into central or the middle third of Kansas the lime and minerals are much further from the surface. Rainfall is in-

PERCENT REACTORS TO HISTOPLASMIN AMONG COWS IN THE WESTERN, CENTRAL AND EASTERN SECTIONS OF THE STATE OF KANSAS

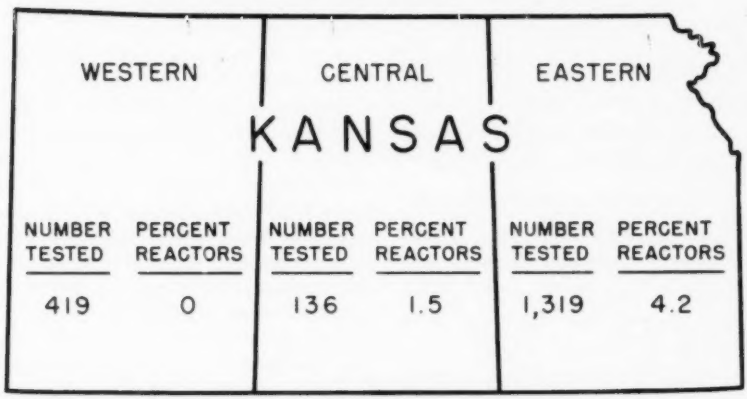


FIGURE C.

creased and the grass somewhat taller. In the eastern third of Kansas the lime has entirely disappeared; rainfall is increased to 37 inches annually and the grass is very tall and appears lush. It is tall, but it is not lush. It is highly carbonaceous and has a minimum of food value for man or beast.

This observation was so dramatic that I started two other investigations. The Kansas State Agricultural College furnished me figure C, which shows histoplasmosis reactors among cows. You will note the percentage increase was almost the same as among human reactors from central to eastern Kansas.

These illustrations show such an interesting correlation between the incidence of histoplasmosis and the mineral content of our Kansas soil and suggest a possible coetiologic factor in histoplasmosis and cancer in its geographic distribution.

While, of course, the above observations do not prove anything, I do think them worthy of thoughtful consideration.

CAROTID ARTERY ANASTOMOSIS IN RADICAL SURGERY OF THE HEAD AND NECK

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NEW YORK, N. Y.

THE compulsory ligation or excision of the internal and common carotid arteries when associated with treatment of tumors of the head and neck has always been a most serious problem. Martin,[4] Watson[6] and McComb[5] individually have reported mortalities in the neighborhood of 50 per cent for the procedure of ligation or excision of the common and internal carotid arteries. Many of those who survive the operation develop hemiplegia. Surgeons have been most reluctant to recommend the elective excision or ligation of the common and internal carotid arteries because of the prohibitively high incidence of these tragic complications. This circumstance has eliminated a definite group of patients for whom in the past only palliation or no treatment was available.

Three surgical technics have been developed in the hope of improving the treatment of patients in this particular group and those in allied groups. These technics consist of (1) the anastomosis of an autogenous vein graft to the common and internal carotid arteries, (2) the ipsilateral anastomosis of the distal severed end of the internal and external carotid arteries, and (3) the use of large tissue flaps to cover and nourish an ulcerating carotid artery or protect and nourish an anastomosis.

From the Head and Neck Service of the Park Medical Group and Surgical Service, St. Vincent's Hospital, New York, N. Y.

Presented at the Fifty-Seventh Annual Session of the American Academy of Ophthalmology and Otolaryngology, Oct. 12-17, 1952, Chicago, Ill.

THE PROBLEM

Treatment of tumors of the head and neck consists of the destruction of the primary tumor and its metastasis by irradiation or surgical excision. Both of the modalities have enjoyed a fluctuating approval under varying circumstances and high hope for irradiation in the early part of the century followed by an astounding improvement in the safety associated with radical surgery of the head and neck as a result of improvement of anesthesiology, biotherapy and electrolytic balance in the past twenty years. These recent advancements are proving successful in many instances where irradiation has failed. This progress has put the head and neck surgeon in intimate contact with the common and internal carotid arteries.

Although it is generally acknowledged that the treatment of multiple metastasis to cervical lymph nodes in cancer of the head and neck is better treated by block dissection of the neck rather than by irradiation, many patients still receive irradiation for their metastasis. The vast majority of these patients are not cured and when the cancer returns in the neck, ulceration may develop with rupture of the carotid vessels and fatal hemorrhage. In many instances when the recurrence is noted following irradiation, radical block dissection is performed and the carotid artery and skin flaps usually heal by primary union without any unusual event under these circumstances. Occasionally, however, necrosis of the skin flaps and carotid artery may occur creating the problem of an exposed necrotizing carotid ar-

tery in the neck. In some instances when the cancer recurs after having been unsuccessfully treated by irradiation, further attempts with additional irradiation may be carried out. These are practically never successful and eventually there is ulceration and regrowth of the cancer. An exposed carotid artery under these circumstances may rupture with fatal hemorrhage. If radical surgery of the neck is attempted there is a strong possibility that a postsurgical, postirradiation necrotization of the skin flaps and carotid vessels will ensue. These particular emergencies with the carotid artery complex certainly do not lend themselves readily to any type of anastomosis, yet there is a small group of patients who will die if the blood supply is not maintained to the brain.

Carotid body tumors developing in the carotid bulb may increase in size to the point where they cause pain and syncope. The policy in the past with these patients has been tragic in some instances when ligation was performed, but in the main it has consisted of a "noli me tangere" attitude. This attitude is undergoing change in view of the fact that carotid body tumors are capable of malignant change and there are now more successful methods available for their cure.

The problems of complete ligation and excision of the carotid arteries in association with trauma, arteriovenous aneurysm and aneurysm of these vessels are certainly of an allied nature but will not be discussed in detail in this paper.

PATHOLOGIC PHYSIOLOGY

Blood supply to the brain is derived from two internal carotid arteries and two intervertebral arteries. These vessels unite at the base of the brain in an ingenious vascular arrangement called the circle of Willis. The dominate source of supply in this vascular arrangement comes from the internal carotid arteries. The hypoxia of the brain resulting from ligation of the common or internal carotid artery is the result of reduced intra-arterial pressure, reduced blood volume in the arterial bed and reduced blood circulation to the brain. The reduction in intra-arterial pressure in the distal segments of the ligated internal carotid artery is approximately 50 per cent. This may vary, however, from 20 to 70 per cent depending upon the efficiency of the circle of Willis, the diameters of the internal carotid arteries and external carotid arteries, and efficiency of the anastomotic network of the face and neck.

Although the significant danger associated with carotid artery ligation is in the abrupt interference with the blood flow through that channel, secondary factors may appear and may indeed be responsible for the patient's death. Cerebral angiospasm, particularly in older individuals may be a serious complication. Stimulation of the superior cervical ganglion and carotid artery nerve should be avoided. Ascending thrombus and emboli to the brain are conditions which may nullify the compensated intracranial circulation by occluding the circle of Willis or middle cerebral artery.

It does not seem, on the other hand, that the abrupt occlusion of the internal carotid artery, in the absence of cerebral angiospasm, thrombus and emboli, could be immediately fatal. Ischemia to the brain in the uncomplicated circumstance is a relative and progressive phenomenon, and the hemiplegia which might develop is in the main a reversible situation if an adequate blood supply is returned to the brain within a reasonable period of time.

RATIONALE

It is clear that the solution to this problem of serious complications and death associated with ligation of the

carotid vessels is the re-establishment and maintenance of an adequate blood supply to the brain. Approximately 50 per cent of the individuals who undergo ligation of the common and internal carotid artery tolerate the procedure without any undue clinical effect and, naturally, require no additional carotid artery surgery. It is the other 50 per cent who will either die or develop hemiplegia that concerns us at this moment. The most effective method of restoring cerebral circulation to normal is by the anastomosis of an autogenous vein graft to the common and internal carotid arteries. This immediately and completely restores the intra-arterial pressure, blood volume and blood flow to normal. Unfortunately local situations existing in the wound in the neck such as post-irradiation necrotization and secondary infection with fistulous formation into the mouth and neck rarely warrant the use of a free graft. Certainly a homologous graft could never survive under these conditions. It is therefore more desirable to utilize the technic of ipsilateral anastomosis of the distal cut end of the internal and distal cut end of the external carotid artery. Even though the intra-arterial pressure is reduced by approximately 50 per cent in this technic, the patient's life may be saved by a free flowing blood channel to and from the brain. There are two circumstances related to this technic which must be reckoned with. The first is that it is occasionally necessary to excise the external carotid artery and its tributaries when a large primary carcinoma is growing in the tongue or pharynx and has metastasized to the jaw bone and neck. Another hazardous factor exists when ligation of the internal carotid artery causes a drop of approximately 70 per cent in the intra-arterial pressure and this drop is not compensated for by a high pressure in the external carotid artery on the homolateral side. Under either of these circumstances one must reconsider the use of an autogenous vein graft.

Intra-arterial pressure readings have indicated that pressure may be higher in either the internal or external carotid artery and that the flow of blood in the anastomosis of these two vessels, which are considered normally terminal vessels, may be from the external carotid artery into the internal carotid artery or vice versa. A high pressure in the external carotid artery stump indicates an efficient anastomosis with the contralateral side or a deficient circle of Willis. The higher pressure in the ligated internal carotid artery indicates an efficient circle of Willis or weaker anastomotic beds. An efficient circle of Willis is the most desirable situation for the patient.

After every effort has been made to re-establish and maintain an adequate blood supply to the brain, the surgeon is frequently nonplussed as to the method of handling the neck wound. If an oral or pharyngeal fistula exists, it should be isolated from the anastomosis. It is usually not possible to attain a closure of the fistula at the time of the anastomotic operation. If the tissue flaps and tissue bed are necrotizing from a postsurgical or postirradiation process, appropriate débridement should be carried out and delayed rotating healthy tissue flaps must be moved into the area to protect and nourish the graft and anastomosis. The tissue flaps are also of value in nourishing the exposed post-irradiation vessels and can be used prophylactically to avoid carotid artery hemorrhage.

INDICATIONS

The indications for ligation, excision and anastomosis of the carotid artery in the treatment of tumors of the head and neck are associated with (1) common or internal carotid artery hemorrhage, (2) impending common or internal car-

otid artery hemorrhage, (3) invasion of the common or internal arteries by cancer, and (4) carotid body tumors.

If it is possible to ligate and excise the common and internal carotid arteries without any intracranial complications, no need for carotid artery anastomosis must be contemplated. At the present time, however, it is impossible to predict accurately which patients will die or develop hemiplegia and which can be ligated without complications. Sudden death as a result of carotid artery ligation in the uncomplicated case is rare. The denial of blood to the brain is, of course, first relative and then progressive, passing from hemiplegia to coma and death. In view of this basic fact, emergency anastomosis of the carotid artery is indicated only when there are clinical signs of cerebral hypoxia. All patients enjoy a period of relative safety, lasting from several hours to several days postoperatively, during which time the cerebral circulation will prove itself to be adequate or inadequate. At the earliest sign of inadequacy of the cerebral circulation, an immediate anastomosis should be performed. In carotid body tumors and all so-called clean cases in the neck, carotid artery anastomosis enjoys the greatest success.

TECHNIC

It is obvious that there is no single operation that will answer all of the problems encountered under the various circumstances associated with carotid artery excision and its effect on the blood supply to the brain. However, once the indications for carotid artery anastomosis are apparent, the technic of the anastomosis is not in itself difficult. The anastomosis is accomplished by the end-to-end approximation of the vessels with interrupted, vaselinized, 0000 silk sutures on atraumatic needles. The diameter of these vessels is usually too small to use the everting mattress suture technic. Hemostasis is accomplished during the anastomosis with appropriate artery clamps. Particular care is taken not to injure the intima and to prevent the adventitia from coming in contact with the lumen of the vessel. Heparin solution, 1:5000, is intermittently dropped on the line of anastomosis and on the suture preparation.[3]

When the anastomosis requires a vein graft, an autogenous vein, 8 to 12 mm. in diameter and 6 to 15 cm. in length, is most satisfactory. The superficial femoral vein fulfills most of these requirements and is the one commonly used. The great saphenous vein has been used, but its diameter is frequently below 7 mm., which increases the technical difficulty of sewing it into the position and also increases the possibility of thrombus formation. The vein is syringed with heparin solution and anastomosed as previously described. Leaks in the line of anastomosis are repaired by additional individual sutures or application of oxycel, which is removed at the termination of the operation before the wound is closed.[1]

The superior cervical ganglion is routinely excised in order to minimize cerebral angiospasm.

It is mandatory that the new vascular channel be protected and nourished by healthy viable tissue flaps. If the neck flaps are necrotic and infected, they should be excised and a healthy flap procured from the opposite neck, shoulder, face or upper chest. Smaller adjacent flaps may be moved immediately. However, in the total reconstruction of the neck a delayed chest flap must be employed.[2] Procurement of the use of these tissue flaps is frequently an integral part of the success of the anastomotic operation, and if it is not accomplished, secondary infection, thrombosis and dehiscence will occur. Rarely is a free skin graft successful under these circumstances.

The initial use of an anticoagulant and biotherapy postoperatively in the complicated case may mean the difference between success and failure of the procedure.

SUMMARY

The serious problem of carotid artery ligation as it exists in surgical treatment of tumors of the head and neck has been analyzed and three technics have been offered for the management and prevention of the serious complications of hemiplegia, coma and death as a consequence of cerebral ischemia. Two of these technics include the anastomosis of great vessels; ipsilateral anastomosis of the internal and external carotid arteries and anastomosis of free autogenous vein graft and the cut ends of the common internal and common carotid artery. The therapy in this problem has been directed primarily at helping the 50 per cent of the patients who would ordinarily die as a result of their carotid artery ligation. I would like this paper to be considered as a preliminary report and ardently hope that it may cause some stimulation and investigation of the serious and interesting problem of carotid artery surgery.

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DISCUSSION

LEWIS F. MORRISON, M.D., San Francisco, Calif.: Dr. Conley is to be complimented on the following points:

1. For the presentation of a practical method of salvage of a certain group of patients who heretofore were unavoidable additions to mortality statistics.
2. For having the foresight and courage to extend radical neck surgery past its former boundaries by incorporating vascular surgery.
3. By presenting ways and means of assuring a cerebral circulation, even though it be diminished as to amount and pressure. This eliminates the certainty of thrombosis of at least a portion of the internal carotid artery that follows simple ligation.
4. For developing tangible criteria for employing either ipsilateral end-to-end anastomosis or autogenous vein graft.

I cannot resist this opportunity to emphasize the point that if the primary lesion had been diagnosed early and if the patient had received prompt and proper treatment, this radical surgery would not have been necessary.

JULIUS A. WEBER, M.D., Seattle, Wash.: I wish to commend Dr. Conley for demonstrating what can be done to salvage more people. It is of interest to all, and particularly to those of us who do both laryngology and neck surgery. By doing an end-to-end arterial and autogenous vein graft, he has made a definite step forward. Even though one enters the neck only to ligate the external carotid for a hemorrhage, one should be prepared for all eventualities. You might have to ligate the internal but may not have the courage to do an anastomosis or graft.

Dr. Conley may be interested in some of our experimental work.

In our laboratory of the Department of Surgery at the University of Washington, autogenous vein grafts were placed in the aortas of 350 pigs and 250 dogs, usually the abdomen or sometimes the chest. Nearly all of these grafts took; however, some of them thrombosed almost immediately. Dr. Conley has had the same experience. But in most cases the vein dilated considerably later on, which means that one should have adequate fascia or muscle to protect these vein grafts when possible.

Dr. Conley mentioned that the skin is not enough to cover some of these veins. In view of this, it seems that the arterial anastomosis should be by far the best, providing pressures are favorable.

Dr. Flothow reported a case of a patient who in 1947 had had a right common carotid ligation, followed immediately by a hemiplegia on the left side (J.A.M.A. 147:1562 [Dec. 15] 1951). Two years later she presented a carotid body tumor on the opposite side, but she still had a residual hemiparesis. As you can imagine, she would be rather hesitant about having the other side operated on. However, the various possibilities were explained to her and she insisted on the operation, so an operation was performed on the other side. Dr. Flothow did a preliminary thoracic sympathectomy. Through a separate incision he went up and took out the carotid body and vessel. There was no postoperative hemiplegia. I mention this only as an adjunct or another way of handling these cases. Dr. Flothow was not aware of Dr. Conley's work, but he was very pleased that he had this result.

Dr. Hunter McKay, in his Navy experience, ligated a number of internal carotid arteries without complications, but he preceded all by doing a cervicothoracic sympathectomy and he was most fortunate in not having any complications. These, however, were mostly in younger people. In people under 20 I do not think we need to worry.

I personally have done only one internal carotid ligation on an adult. This was done for hemorrhage and by a slow, one-hour gradual ligation. The result was fortunately without complications.

We should encourage more men to do neck surgery, and Dr. Conley should certainly be an example for all of us.

In doing neck surgery, if one even remotely suspects the possibility of having to ligate or cut the internal carotid, I should like to emphasize the following points, most of which have already been mentioned by Dr. Conley:

1. Gain as much preoperative information as possible regarding the collateral circulation, perhaps injecting dyes.

2. Administer antihistaminics preoperatively.

3. Make an adequate surgical exposure.

4. Use extreme gentleness in the handling of the carotid, especially in the region of the bifurcation, to avoid vasospasm.

5. Place a loose, partially constricting ligature low on the common and high on the internal carotid as they are exposed, thus creating a safety measure in the event that either the surgeon or assistant inadvertently injures the vessel, in which case the ligature may be quickly tightened. This preliminary, partial constriction also helps to prevent the sudden cerebral circulatory change that may accompany the clamping off.

6. Using a 1 per cent solution of novocain make an injection of the carotid sheath as you proceed, especially in the carotid body region.

7. Remove the superior cervical ganglion.

8. Again do the slow, one-half to one hour ligature compression or use a clamp, (for example, the Selver Stone clamp) to compress the vessel gradually.

That brings up the last two more recent points. One is to do the preoperative or postoperative cervicothoracic sympathectomy and then go ahead with surgery. The other is described in this excellent presentation of Dr. Conley's; that is, the anastomosis of the internal and external carotids or a free autogenous vein graft of the cut ends of the internal and common carotid arteries.

Dr. Conley's excellent work and observations give us a great deal of interesting information and especially courage to tackle these cases that involve the internal carotid. We will be most interested in his further reports.

PRISMATIC LENSES FOR VERTIGO AND SOME EXPERIMENTAL BACKGROUND FOR THE ROLE OF THE EXTRINSIC OCULAR MUSCLES IN DISEQUILIBRIUM

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PARIS, FRANCE
BY INVITATION

Edited by
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NEW YORK, N. Y.

REPORTS of the symptomatic relief from various vertigos using prismatic lenses as reported by Utermöhlen[19] and his colleagues[10] in Holland stimulated us to undertake experiments to try to explain his findings. Although Utermöhlen and others, especially in France,[14,17] have tried to give explanations, none of these are entirely acceptable. This paper is to introduce the subject in the United States and to report certain new observations and conclusions in the field. It is felt that the seeming contradiction of some of the theories may be due to lack of knowledge of the many factors involved in equilibration, especially the effects caused by confusions in the tonus reflexes from the extrinsic eye muscles.

In this paper equilibrium will be used to mean the "even balancing of the body" achieved by an even balancing of the several sense organs which are concerned with its maintenance. "Disequilibrium" will mean a faulty equilibrium in the broad sense. There are thus objective signs of disequilibrium such as faulty posture or walking with a "broad base," as well as subjective signs such as the sensation of turning or a feeling of disorientation in space.

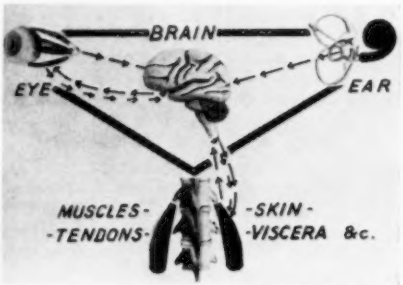

FIG. 1—The equilibratory triangle. If reflex balance is not maintained between all the component parts of the organs making up this triangle, confusion occurs in the brain and vertigo may result. If compensation occurs and then the balance is again upset, disequilibrium may again occur.

The mechanisms which must be balanced to maintain equilibrium in vertebrates consist of closely correlated reflex connections between the eyes, the vestibular labyrinths, the muscles, the tendons, the skin, the viscera and the connections of all of these to the central nervous system (fig. 1). The direct influences of the eyes and of the labyrinth are comparatively well known, but one needs only to study the sensations and reactions occasioned by a spin in an airplane or in a Link trainer with the various apparatus for real or simulated blind flying to be convinced that indirect influences and other organs are also important. It is hoped that further

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elucidation of the relative importance of each of the conscious and unconscious factors concerned with equilibration and the autonomic effects in disequilibrium will eventually be forthcoming. This paper can only suggest some of them.

As mentioned previously, disequilibrium may be produced by interference with the normal function of reflex arcs from any of the organs, which are concerned with equilibration. However, an abnormal sensation of turning, "vertigo" in the true sense, only occurs if there is an imbalance somewhere in the system. Often if sufficient retraining occurs in remaining normal parts of the controlling mechanisms, compensation takes place and since there is then no functional imbalance, vertigo no longer is suffered except under special circumstances, such as fatigue, for example, which may interfere with the acquired compensation.

Armstrong[1] states, "If vision is eliminated during (airplane) flight, all the other organs of equilibrium have been found to be inadequate and the pilot becomes hopelessly confused." In aviation medicine it has been known ever since the epoch-making discoveries of Myers,[15] Poppen,[16] and their confrères in regard to blind flight that the eye is the most potent force in the equilibratory system. If vision is scrupulously relied upon, the brain can be taught to disregard the sensations brought to it by other organs. However, the eye is subject to false sensations and can itself produce vertigo and disorientation in space. Suffice it to say, vertebrate equilibratory systems are adequate for ordinary stimuli but they are often inadequate for excessive stimuli whether from high speed machines or from pathologic processes.

Disequilibrium can be caused in fish[3-6] not only by disturbing the balance of the extrinsic ocular muscles by selective cutting of their tendons but also by cutting of the fins on one side (figs. 2 and 3). Both these operations produce turning behavior. There is definite rotatory disequilibrium similar to that obtained by labyrinth stimulations or ablations. In recent experiments somewhat similar

FIG. 2.—Predominant turning directions of fish following operation on external eye muscles and behavior of various controls. Note: top row is key.

FIG. 3.—Turning of fish when fins are not symmetrical.

findings have been obtained in mice by cutting the extrinsic muscles of the eye and by cutting the neck muscles.

On the other hand, enucleated fish or mice show no disequilibrium even if there is violent stimulation (fig. 4). For example, if three mice (one normal, one blind with eye muscle in place and one with enucleation) are simultaneously rotated ten times in ten seconds, the enucleated mouse will act differently than the normal or the mouse blinded without severance of the extrinsic bulbar muscle tendons. Normal mice and blind mice with their extrinsic eye mus-

FIGURE 4a.

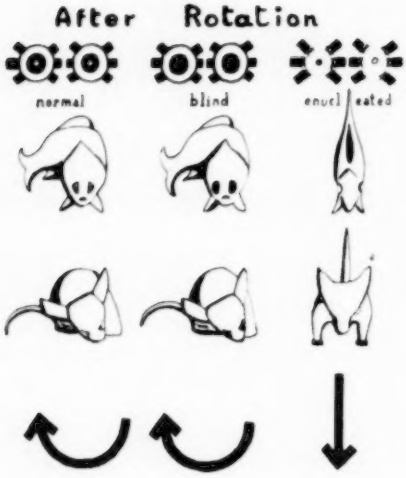

FIG. 4.—Dominant movements of fish and mice after rotation. Note that when eye muscles are detached, there is no vertiginous behavior and that loss of vision is not a factor.

cles attached to the globe hug the table, spread their feet and tend to walk in a circle and always in the same direction if they move at all. The enucleated mouse will walk about the table in any direction with a normal gait and will very often walk in a straight line. Apparently there is no sensation of vertigo in the enucleated mouse (just as there is none in the fish) even if he has an intact labyrinth. Similarly, none of the patients who had both eyes enucleated for one reason or another, when questioned, reported any sensation of vertigo after irritation of labyrinth.[2,7] These experiments suggest that imbalance in the intrinsic ocular muscles and the nerve impulses originating from them may be an important factor in the sensation of turning. Studies of human tropias and phorias can lead one to a similar conclusion.

Most individuals have normally more or less eye muscle imbalance and thus potential diplopia. About 64 per cent have esophoria, 34 per cent have exophoria and less than 2 per cent have perfect orthophoria, according to Scobee.[18] With vestibular stimulation a new relative esophoria or exophoria appears and subjective diplopia can be made out.[2,7,9,12,13] When the new esophoria or exophoria (actively, the diplopia) is corrected with prismatic lenses, there is a markedly reduced sensation of vertigo. Correction of the diplopia from labyrinth stimulation can be made by elimination of the new phoria on the eye of the side of excitation by placing a prism base out (fig. 5a).

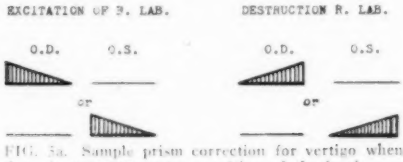

FIG. 5a. Sample prism correction for vertigo when there is no compensatory position of the head.

But in case of destruction of the labyrinth the eye is deviated outward on the side of the destruction and the correction then will be reversed.

This is the correction given in the case of patients who have a compensatory position of the head. It will be reversed when there is no compensatory position of the head (fig. 5b).

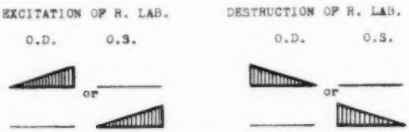

FIG. 5b. Sample prism correction for vertigo when there is a compensatory position of the head.

The prescription of the angulation of the prism in each case can, of course, also be on any of the following bases:

1. Full correction can be for one eye with one prism.

2. Correction can be for the two eyes by using prisms whose total angulation equals the full correction for one eye by addition.

3. By subtraction (fig. 6).

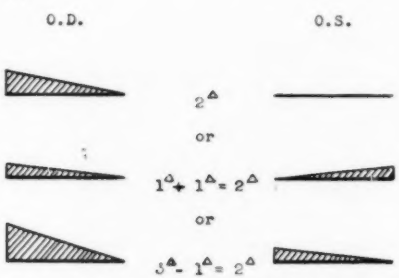

FIG. 6—Variations in the prescription of prisms to obtain a total 2° effect on the right eye. (Upper) Used very commonly because often the correction need only be 1° or even 0.5°. Plain glass in the left eye is more comfortable and consistently acceptable than glass on one eye. (Center) Makes it possible to obtain maximum angulation without an excessively thick prism on either eye. (Lower) Primarily used only for experimental purposes or where the angulation is involved with stimulation which is not in the usual horizontal plane.

The prismatic correction in a normal individual should be back to his normal esophoria or exophoria rather than to a theoretical orthophoria. If the stimulus is excessive, the vertigo may be present for a few seconds, but the duration of the sensation of turning is usually very much shorter than without the prisms. If the sensation of vertigo has been eliminated with a prism and then the prism is removed, vertigo will reappear only to disappear again with reinsertion of the prism into the trial frame. Contrariwise, vertigo can be increased by inserting the prism with the base in a direction which increases an extrinsic eye muscle imbalance. Apparently in human beings the average normal irregularities in the extrinsic eye muscle tension may be increased by vestibular stimulation, and this imbalance in the equilibratory mechanism complex produces a sensation of vertigo.

When this concept is applied to patients with vertigo, it is found to be most useful. For example, patients suffering from the vestibular imbalance of streptomycin poisoning often complain of vertigo and of blurred vision.[11] They have nystagmus on lateral gaze in either direction. A few are actually aware of diplopia. On examination with Maddox rods, or the cover test, considerable muscle imbalance is always found. When the muscle imbalance is partially corrected, the vestibular imbalance virtually disappears even in poor light.[8] Since the amount of his normal extrinsic muscle imbalance is usually not known, the precise prescription for each patient must be ascertained by trial and error. When the right combination is found, the patient immediately walks without a "broad base," can turn without falling, can tie his shoes, can stand on one foot, does not extend his arms on turning and feels no sensation of nausea (fig. 7). The effect of wearing the glasses often lasts for some minutes after they are removed. Prismatic lenses are therefore recommended for trial in all patients as soon as they complain of disequilibrium from streptomycin poisoning. This may be while the patient is still confined to his bed. Since older persons take longer to compensate for the loss of the labyrinth than younger persons, they will more often need the prisms and will need to wear them longer. The examination for muscle imbalance and trial of the prisms can be done in bed in the tuberculosis or general and surgical wards. The prisms are first experimentally clipped onto the patient's own spectacles or onto an empty frame. If they are necessary for extended periods, they can be incorporated into the patient's own prescription. This is rarely necessary in streptomycin poisoning because the prismatic glasses greatly shorten the time necessary for the usual compensatory mechanisms to take over.

Other patients with vague vertigos, which have previously defied diagnosis, will occasionally be found to obtain symptomatic relief from prismatic lenses. Those who can be helped can often be spotted by observing the curvatures of their lumbar, thoracic and cer-

FIG. 7a.—Poorly compensated patient with total loss of vestibular response following streptomycin therapy.

FIG. 7b.—Same patient wearing corrective prisms.

vical spines. If there is a curvature unexplained by spinal or muscular pathology, the prisms will often help not only the vertigo but the pain in the back or cervical muscles which often develops in these patients when they are fatigued. It is suggested that perhaps general fatigue affects first the ocular muscles, which gives a disequilibrium, and this in turn affects the neck and back muscles. These muscles, when they are held in an abnormal position long enough, develop cramps and become painful. There may well be some similar sort of fatigue effect in the extrinsic muscles of the eye in cases of vertigo for, as mentioned above, if the correcting prismatic glasses have been worn for a time, the vertigo often does not reappear immediately on removal of the glasses. It may be that the prismatic correction "rests" the eye muscles which are involved in the disequilibration and that they are then able to maintain physiologically normal relations until they become fatigued again by unequal strains produced by vestibular or other stimulations of the equilibratory system.

Prismatic lenses will often reduce the vertigo in unilateral dead labyrinth cases. It will often help in the labyrinthitis following a fenestration operation. We have seen patients immediately following a fenestration operation who were deathly ill if they moved their heads without the prismatic lenses, yet when wearing them they could sit up, eat a full meal and retain it. To be sure, some fenestration patients have very little, if any, vertigo, nausea, or vomiting, but there are others in whom the prismatic lenses solved a very annoying problem in the first few postoperative days. Improvement in vertigo after fenestrations has also been reported by Utermöhlen,[21] and Moulonguet and Ribéra.[14,17] They, incidentally, always prescribe prisms with the base in.

In Ménière's disease with frank and violent paroxysmal attacks of vertigo the effect is less dramatic in our hands, except in those patients who are having several attacks per day or who have the very common, mild feeling of imbalance between attacks. Apparently, if the stimulation is not too severe the sensation of turning can be alleviated by these glasses.[14,20]

So far we have had little experience with so-called "ocular vertigo," but some patients so diagnosed have had more or less success. The principles of trying to correct even a minor muscle imbalance should be studied for all those wearing spectacles. It is possible that the slight vertigo so often seen in patients after a new prescription for glasses is tried may be due to imbalance of the type obtained by reversing the prisms after alleviation of vertigo has been achieved with a certain combination.

There are many observations and explanations to be made, but suffice it to say that in some types of vertigo, especially the vertigo of streptomycin therapy, properly adjusted prismatic lenses are often clinically useful for symptomatic relief. There is some indication that prismatic lenses may be useful to certain individuals who are susceptible to car sickness or seasickness. They may be useful to those who become dizzy at heights or on looking upward during their work. Whether they will be useful in aviation medicine remains to be seen.

SUMMARY

To substantiate the rationale for the use of prismatic glasses, three observations have been made on animals to demonstrate the action of eye muscles in equilibrium.

1. Excitation of labyrinth of enucleated fish and mice does not give any circling motion, such as occurs physio-

logically on the normal or on the blind animal.

2. Circling motion can be produced on fish without an excitation of semicircular canals by cutting the abductor muscles of the eye and producing an imbalance in the tonus of the eye muscles.

3. Relief of imbalance by resuturing of the muscle restores equilibrium and the fish can again swim straight.

Starting from these experiments, it was shown in France:

1. That in exophoric and esophoric persons, irritation of the labyrinth produces nystagmus, vertigo and diplopia. This diplopia is caused by an inward rotation of the eye on the side irritated.

2. This diplopia can be relieved by prism lenses and the vertigo made to disappear.

3. This diplopia does not appear in completely orthophoric persons who never get vertigo from excitation of the labyrinth.

4. This diplopia may or may not be associated with compensatory deviation of the head.

Practical application of this investigation is in the symptomatic therapy of vertigo from Ménière's disease, streptomycin poisoning, fenestration, and car, sea, air, and mountain sickness.

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DISCUSSION

ARAM GLORIG, JR., M.D., Silver Springs, Md.: I have been intimately associated with Dr. Fowler for a matter of ten years and feel considerably honored to be discussing any paper presented by him or any of his group. In this case, however, I would feel better had this present honor been bestowed upon someone else.

Although I have a more than passing acquaintance with the labyrinth, it is with considerable fear and trepidation that I enter into this discussion. According to what we have just seen if prismatic lenses are placed before the eyes of an individual, the sensation of turning or vertigo will immediately cease. There seems to be no doubt about the result. From reading the literature, there is some confusion as to the position of the lenses, however.

Utermöhlen states that the bases of the prism should be placed nasally. This is true whether one or two lenses are used. He also states that if this position is reversed, the vertigo will increase in severity. This has been agreed to by other European writers. Today's paper has indicated it makes no great difference which way the base is placed and that one prism will usually be effective, the other being used more or less for cosmetic balance.

At this point I would like to ask Drs. Fowler and Baron to give us a simple formula for deciding what the lens prescription should be.

One thing is certain in the relatively sparse amount of literature, however—varying strengths of prisms are needed. It is also apparent in the literature that vertigo is relieved in conditions such as Ménière's complex and postfenestration.

To state that it works is simple but to explain how it works is the reason I wish Dr. House had asked someone else to discuss this very provocative paper.

It is generally stated that vertigo is due to a dual stimulus, one from the eye and one from the labyrinth. These effect the central nuclei in such a way as to induce a sensation of vertigo of different degrees of severity. If this is so, then a definite cyclic influence must be established. If then something can be introduced to break up this chain, the vertigo should be relieved.

To support this, Spiegel says anything which will serve to reduce ocular convergence will reduce vertigo. This fits very well with Utermöhlen's statement that the prism bases should always be placed nasally.

It is well known, too, that vestibular and optokinetic stimuli are directly related. It is also known that the optokinetic usually has the upper hand in this relation. I would like to read part of a letter from Dr. Joe Hawkins of the neurophysiology department at the Merck Institute for Therapeutic Research.

"Observations which we have made in electrophysiological experiments at the Merck Institute seem to bear on some of the questions raised by this paper. We have found that pentobarbital and certain antihistaminic agents, notably Neo-Antergan, Pyribenzamine and Phenergan, tend to reduce the optokinetic nystagmus which occurs when a cat is rotated with the eyes open, and that this reduction in the optokinetic response permits a far more vigorous post-rotational vestibular nystagmus than is normally seen with the eyes open. This latter effect must be entirely a matter of the release of the vestibular mechanism from inhibition by the optokinetic, since vestibular per- and post-rotational nystagmus recorded with the eyes covered is unaffected by these drugs. Although we have no direct proof, we are tempted to suppose that one factor in the control of motion sickness by certain of the antihistaminic agents may be this resolution of an optokinetic-vestibular conflict in favor of the vestibular mechanism.

"The second relevant observation is that injury to the vestibular end-organs by the ototoxic action of streptomycin leads, in the cat, to what must be a most discouraging, though temporary, loss of control of the eye movements, especially the ability to follow a moving object (such as a mouse). There is virtual elimination of the optokinetic nystagmus, in addition to total loss of the vestibular response. A similar phenomenon is the blurring of vision reported by some patients whose vestibular apparatus has been affected by streptomycin. It appears that the normal control of the saccadic eye movements and associated

head movements is dependent upon an intact vestibular system, which both facilitates and acts as a brake.

"In Dr. Fowler's experiments matters seem to be more or less reversed, since he is controlling the symptoms usually attributed to the vestibular system by altering the conditions of vision. Perhaps this is possible only in man, and only because the optokinetic system in man has outstripped the vestibular in importance. I am inclined to suggest, however, that it is the resolution of the conflict between the messages conveyed to the midbrain from the eyes and from the labyrinths, rather than the primacy of the optokinetic system, which is more likely to account for the results he has reported."

During my own work with the vertigo associated with streptomycin poisoning, I found that if a concentrated voluntary effort to fix the vision on a far point was made by the subject, vertigo was reduced materially. This would tend to support the statement that if the ocular movements are fixed by some external influence the chain is broken and vertigo relieved. Also the need for prisms of different strength exerting different degrees of effect supports this. It seems then that the shifting of the image produced by the prism causes the eye to attempt to fix, and because of an influence extraneous to the chain, the vertigo is reduced or relieved.

As usual, Dr. Fowler and his group have given us something to think about. Perhaps this time next year we may have a more satisfactory explanation as to the how and wherefore of this baffling but fascinating phenomenon.

ARTHUR LINKSZ, M.D., New York City: Thank you for the privilege of letting me discuss this paper. There is not very much I can say, but there are some questions I can ask. I am an eye doctor and I look at these things from a slightly different angle. I had the privilege of meeting Dr. Utermöhlen when he was in New York some years ago, and since I am interested in the treatment of oculomuscular disorders by prisms, I had been looking forward to this meeting. I must say that I could not understand his explanation as to why prisms should work in Ménière's disease.

One of the reasons I could not see his point was this: For many years we were taught that the extraocular muscles are singularly lacking in sensory end organs which allowed feed-back of proprioceptive message from these muscles toward the central nervous system. The change of tension in the musculature of the neck, or a change in the distribution of pressure in the labyrinth, will have a motor effect on the eyes but we have always thought that, vice versa, a change of tension in the extraocular muscles has no effect upon any other bodily structure. I must say that in the last two or three years we have changed our attitude to a certain extent. There seems to be definite evidence for the existence of end organs of proprioception in the extraocular muscles. With this, the existence of a feed-back mechanism from extraocular muscles toward the central nervous system is at least a possibility and an influencing action through the extraocular muscles upon the central nervous system is at least thinkable.

The other reason why this work is of interest to me is my belief in the effectiveness of weak prisms in the therapy of oculomuscular disorders. It is more important to correct a small heterophoria than a large one. Correction of small heterophorias has the most dramatic effect. Only if the binocular system is almost normal, only if it is a compulsion to use the two eyes together all the time and for all purposes, will a small inaccuracy become a frustrating hindrance of effectiveness which should be always and constantly corrected. I want to stress this point on account of its general biologic interest, even if this might not be of especial interest to an audience consisting of otolaryngologists.

A person with convergent strabismus never has eyestrain. He doesn't use his two eyes together; he is under no compulsion to adjust. Small differences in refraction, small differences in image-size (so-called aniseikonia) always cause eyestrain and, for the very same reason, a small imbalance of the oculomuscular system will cause eyestrain.

As far as vertigo is concerned, I too, believe that it is an outcome of conflicting information given by different sensory systems to the same central nervous system and that therefore the eyes can contribute to both the cause and cure of dizziness.

This is the positive side of my interest in the problem. But from here on I can only ask questions. However, before doing this, I should like to mention a point of general significance. Diplopia is a condition known to the layman. It is one of those generally held half-truths that he who is drunk sees double. Until a few years ago, we did not know much about the mechanism of this diplopia. The general idea was that alcoholic intoxication loosens control over our eye muscles and makes therefore manifest whatever latent mus-

cular imbalance we might have. It was believed that if a person is exophoric (which means that under cover one of his eyes turns out), then, under alcohol, he will show divergence; if esophoric, then his eyes will cross. This belief has been proved erroneous.

The effect of alcoholic intoxication is a convergence impulse upon the eyes. A person with orthophoria, under alcohol, will develop esophoria. A person who is esophoric will become more so; a person who is exophoric will show less exophoria. In other words, all of them will show an increase of convergence tonus. The same is true in anoxia, e.g., in the high altitude chamber. Here, too, oculomuscular disturbances occur and they indicate an increased influx of impulses upon the convergence rather than the divergence mechanism.

Theoretically then, I am most favorably inclined toward the paper just presented. I do believe that the central nervous system can be influenced via extraocular muscles and I do believe in the helpful effect of weak prisms. But I would have been much happier about this presentation were it not for the seemingly random influence attributed to the labyrinthine stimulus. The examples just given show that central nervous influences upon the extraocular muscles show a definite pattern. Why should the influence of the labyrinth upon the extraocular muscles be without any pattern?

I have witnessed a number of experiments by Dr. Baron at the Manhattan Eye and Ear Hospital. In those experiments a change was looked for in the oculomuscular balance of patients after induction of cold water into one of the ears. Although I do not know much about labyrinthine physiology, I know that induction of cold or warm water affects the extraocular muscles in the opposite manner, just like the patients' being turned in one or the other direction does. I cannot see how all these procedures could have the same effect upon heterophoria and why they should have a random effect.

What I would like to ask is that further investigation be done in this direction on normal persons. Only after careful studies have been done on normal persons shall we be able to understand how the labyrinth affects the extraocular muscular tonus and equilibrium. I cannot see how depression of labyrinthine function by streptomycin on the one side and irritation of the labyrinth by rotation in the Bárány chair on the other could have the same effect upon the extraocular muscles. Let me repeat: I do believe in the corrective capacity of weak prisms, but I cannot see why what is to be corrected should be esophoria in one case, and exophoria in the next. Just like alcohol or anoxia, streptomycin poisoning must have some definite and uniform effect. Let's find out what this effect is and then correct it with prisms.

There is another point upon which an ophthalmologist must look with misgiving. Some of the reported cases were given a base-in prism for one eye and a base-out prism for the other, at the same time. For an ophthalmologist this is a strange procedure. We always look at a prism as an instrument which affects both eyes. Like Dr. Baron, we measure the heterophoria with a Maddox rod and then give either base-in or base-out prisms to correct it. Instead of a prism of two diopter power placed base-in in front of one eye and a prism of two diopter power placed base-out in front of the other eye (the latter offsetting part of the prismatic action of the former), why don't the authors put a prism of one diopter power, base in, just in front of one eye? Of course I might be mistaken and it might be that this is just the way it has to be done. From as much as I have seen of Dr. Baron's measurements, the technic is not refined enough to justify this.

DR. FOWLER: I am sorry that I cannot answer Dr. Linksz's ophthalmological questions very well. As an otologist I simply summarize the situation as follows:

Starting from the experiments shown in the film and from the experiments done by Dr. Baron in France, I think it is apparent that the eye muscles have something to do with disequilibrium and vertigo. I agree with both the discussers that there is a sensory confusion that causes the feeling of vertigo. This is the main point of the presentation. Dr. Baron feels that the diplopia that he described after irritation of the labyrinth is relieved by prism lenses, that because sensory confusion is thus eliminated the vertigo disappears.

In answer to Dr. Linksz's question regarding to which eye to apply the prisms, apparently whether they are applied to either or both eyes the same final result can be obtained.

Labyrinth irritation or destruction may or may not be associated with compensatory deviation of the head, and apparently it makes a difference where there is a compensatory deviation of the head as to whether the prisms are put on one way or the other.

The multiplication of the many different ways of correcting exactly the same muscle

imbalance in one eye or the other and the reversals necessary for labyrinth irritations versus labyrinth destruction, not to mention positioning of the head, makes for the confusion in this ophthalmologic situation. I think the way to resolve it is for the otologist to sit down with diagrams, read the paper, and discuss it with an ophthalmologist who understands prisms, muscle imbalance and their vagaries. There are so many ways of putting on the prisms that one begins to think for a while that it does not make any difference which way they are put on. However, if you happen to put them on the wrong way, the patient may fall down. We have experimentally increased many patients' vertigo by reversing the prisms. Some of the lack of understanding seems to come from the fact that the average ophthalmologist had not considered the increased phoria or actual diplopia that comes from labyrinth stimulation.

I think that Dr. Baron might be able to answer some of the detailed ophthalmologic questions if we may still be permitted the time.

DR. BARON: I want to tell Dr. Linksz that in a paper written by Cooper, Damel and Whitteridge, published in the Journal of Physiology, 133:463-474, May 28, 1951, the authors show that in the extrinsic muscles the spindles act only under impressions given by one or two degrees deviation.

In some experiments that I pursued at Wood's Hole with the technic of S. W. Küffler in picking up the current of action of the small fibers of the third, fourth and sixth nerves, I have shown that the current can disappear. This current, which is an efferent current coming from the eye muscle, disappears when we have a tension greater than two or three degrees on each eye.

I am very sorry to have to correct what Dr. Glorig said about the experiment. What I am doing when I put the prism on is correcting the deviation of the eye. I add for the instruction of Dr. Glorig and to correct his lack of information and bibliography about this work, that all the experiments presented in this motion picture are my own work and were done in France one or two years ago.

DOUBLE PURPOSE INSTRUMENT FOR KERATOPLASTY

RAMÓN CASTROVIEJO, M.D.
NEW YORK, N. Y.

MORE than fifteen years ago I developed a double spatula to be used for keratoplasty. The instrument was never reported separately, but an illustration of it appeared in an article published in 1941.[1] One end of the instrument was an iris repositor and was used mainly to handle the iris and to even the tension of the sutures after they were tied. The other end was wider, resembling the flat spoon used for cataract surgery and measuring approximately 5 by 7 millimeters. This spoonlike portion of the instrument was used to lift and hold the corneal graft. At the time the above-mentioned instrument was described, the average graft used varied from 5.0 to 6.5 millimeters and the size of the graft carrier was adequate.

During the past few years, with the use of much larger grafts such as those employed for total lamellar and total penetrating keratoplasties, which measure up to 11.5 millimeters in diameter, a much larger graft carrier seemed to be required. The present instrument was developed to handle grafts as large as 11.5 millimeters in diameter.*

One end of the new instrument retains the same iris repositor (B) described in the previous model. The other end is circular (A), has a flat fenestrated plate 12 millimeters in diameter. Along the edge of the plate a ridge rises 2 millimeters, with openings in opposite ends 5 millimeters wide. The graft, once dissected, is deposited in this graft carrier where irrigation with antibiotic solutions and other manipulations, such as inserting sutures, etc., can be carried out before placing the graft in the recipient's eye.

FIGURE 1.

The fenestrations in the plate and the two openings in the ridge surrounding the plate serve to drain the irrigating fluids poured onto the graft.

From the Institute of Ophthalmology, Columbia Presbyterian Medical Center, New York.
Presented as a *New Instrument* at the Fifty-Sixth Annual Session of the American Academy of Ophthalmology and Otolaryngology, Oct. 14-19, 1951, Chicago, Ill.

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* Manufactured by E. B. Meyrowitz Surgical Instrument Co., Inc., 520 Fifth Ave., New York.

NEW HANDLE FOR RAZOR BLADE KNIVES: MANNER OF PREPARING THE BLADES

RAMÓN CASTROVIEJO, M.D.
NEW YORK, N. Y.

IN 1932 I described a simple way of making very sharp knives out of razor blade material.[1] In 1933 a new handle to hold these blades was described and the handle-knife combination published as a new knife for ophthalmic surgery.[2] Although the handle described in 1933 had a quick-acting mechanism which permitted an easy change of the blade by turning a thumb screw and was simple enough, a new handle has been designed which further simplifies the previous one.*

The handle has been given an octagonal shape in order to facilitate holding it comfortably and securely in any position. Blades, not too flexible and single-edged, such as those illustrated in Fig. 2-a, have been found most desirable. Figure 2 illustrates the simple way of cutting these blades, shaping them to fit the handle. The blade is cut with special nippers (A). One of the limbs of the nippers has been replaced by a piece of steel with a groove ground into it, where the cutting edge of the other limb of the nippers fits. A stop plate screwed under the grooved limb of the tool serves to support the razor blade (b), resting the blade on the plate upon the dull border. With these nippers the blades can be cut lengthwise in two portions, one 3 mm. wide (c) containing the cutting edge and the remaining portion (d) of the blade to be discarded. The portion with the cutting edge is then cut obliquely (B) and finished as a knife with the shape represented in (e). The finished blade is then inserted into the handle and the utility knife (C) is ready for use.

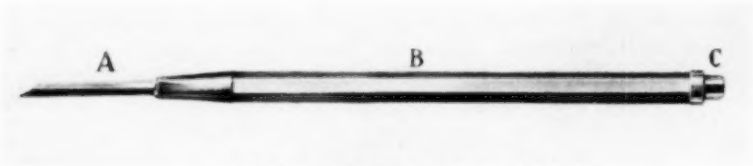

FIG. 1—Author's new handle for razor blade.

In the new model (fig. 1) the handle (B) is hollow, having therein a slideable blade or chuck provided with jaws on one end to hold the blade (A), a push button (C) on the other end and a spring within the handle which permanently tightens the grip of the jaws on the blade. Pushing the button releases the jaws permitting the blade to be removed and a new one inserted. By releasing the pressure on the button, the jaws again clamp the blade firmly and the instrument is ready for use.

I have found that this inexpensive knife, so easily made with first quality razor blade material, compares favorably with knives of considerably greater

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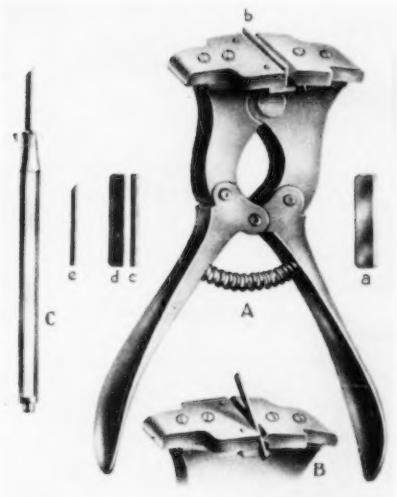

FIG. 2—Manner of preparing blades from razor blade material to fit the handle.

cost. On account of the low cost of these knives, a new one can be used for each operation, a great advantage over more expensive types of knives which require sharpening when they become dull. This utility knife has been found useful in operations on the lids as well as on the eyeball, including delicate procedures such as keratoplasties and keratectomies. The knife has also been found valuable outside the field of ophthalmic surgery, in plastic surgery and in other delicate surgical procedures.

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IMPROVED NEEDLE HOLDERS

RAMÓN CASTROVIEJO, M.D.
NEW YORK, N. Y.

AT the 86th Annual Meeting of the American Ophthalmological Society in 1950,[1] I presented a new needle holder with the following characteristics:

It is simple in construction, is streamlined, and has no protruding parts on which the sutures may be caught. It is narrow enough so that it can be rotated in the fingers, and is of the proper size so that it can be comfortably held in the hand, either as a pencil or as a fork is held. Slight pressure locks or releases the jaws. The locking and releasing mechanism works equally well in whichever position the instrument is held. When the needle holder is open the locking parts are wide apart. The jaws, which are finely knurled, can hold the smallest needles used in ophthalmic surgery. Slight pressure on the holder presses the jaws firmly together before actuating the lock. In this position the instrument should also hold an 8-0 silk suture, thus permitting tying without having to lock the holder. Furthermore, in this unlocked position, the jaws should hold the finest hair well enough to permit the use of the instrument as an epilation forceps. Slight increase of pressure locks the holder permitting the operator to release his grip and to manipulate the needle with a minimum of tension on the fingers. From the locked position, slight pressure releases the lock mechanism and returns the holder to the open position.

In the new model presented now, the following improvements have been introduced. The jaws (fig. 1A, a and C, a)

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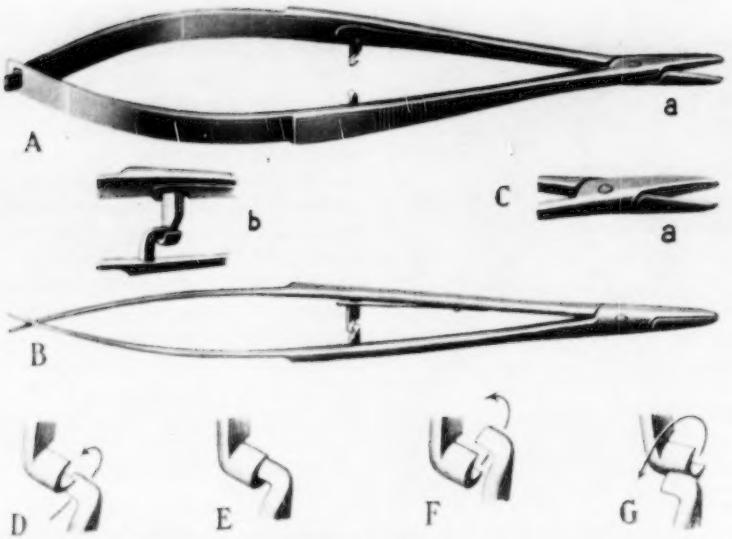

FIG. 1.—First model of author's improved needle holder.

are no longer knurled, as it was discovered that the jaws without knurling hold better the finest surgical needle, the finest thread and the finest hair, thus permitting the use of the instrument also as an epilation forceps. The jaws have been made finer and the joints have been slightly rounded to prevent them from catching the threads while tying the sutures. The locking mechanism (fig. 1b, D, E, F and G), which in the previous model occasionally got out of order, has been improved rendering a more efficient and smoother performance of the instrument. The spring blades (fig. 1A and B), which in the previous model were permanently attached, in the new model can be disengaged in order to facilitate cleaning of the instrument.*

A second modification of the needle holder has the characteristics of the one just described, except for the locking mechanism which is somewhat different but performs on the same principle. Another model of needle holder with the same shape but with sliding-locking mechanism was also made but found unsatisfactory.

A fourth model was made with a triple joint to actuate the jaws. It was believed that this triple joint would increase efficiency of performance, but on the contrary, the instrument was found to perform less efficiently. Furthermore, on account of the more complicated design, it was costlier to manufacture.* The only purpose in reporting these last two needle holders is to avoid duplication, indicating their inadequacy for clinical trial.

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*The original model of this needle holder and the recently improved one are manufactured by E. B. Meytowitz Surgical Instrument Co., Inc., 520 Fifth Avenue, New York.

*These models are manufactured by Storz Instrument Co., 4570 Audubon Ave, St. Louis 10, Mo.

MOTORIZED INSTRUMENT FOR DACRYOCYSTORHINOSTOMY AND CATARACT EXTRACTION BY SUCTION

RAMÓN CASTROVIEJO, M.D.
NEW YORK, N. Y.

THE present instrument has been devised with the purpose of furnishing a motorized instrument of small size and cost which can be used both for dacryocystorhinostomy operations and cataract extraction by suction.*

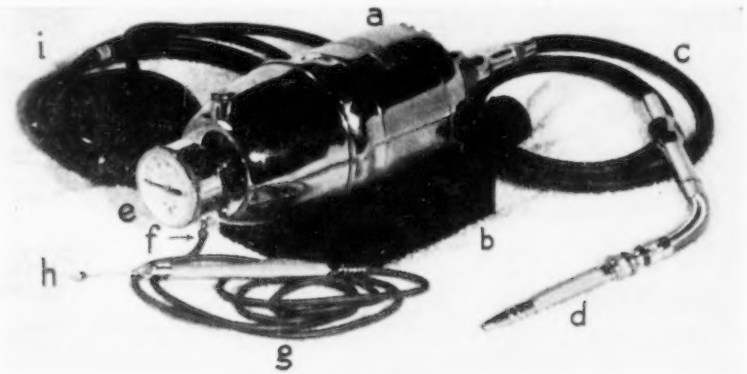

FIGURE 1.

The instrument consists of a motor (a) 1/10 H.P., AC-DC current, 110 volts and 60 cycles. An end of the motor connects a flexible shaft (c) with a dental handpiece (d), where the burrs to be used in dacryocystorhinostomy operations are attached. At the opposite end of the motor is placed the suction mechanism. A gauge (e), marked in centimeters from 1 to 65, registers the amount of vacuum delivered by the instrument, 65 centimeters having been considered the maximum required for the extraction of any type of cataract. The amount of vacuum can be regulated by a single valve control (f) located under the registering gauge. The rubber tubing (g) connects with the valve control and any type of suction cup or erisophake (h) may be attached to the other end of the rubber tubing. The motor, chromium-plated finish, is fastened to a plastic base (b) where an electric plug connects with the electric outlet through a foot-control switch. The motor is kept in a leather carrying case which permits the dual operation of the instrument without removing it from the case. The flexible shaft for dacryocystorhinostomy can be detached from the motor when the instrument is to be used for suction only.

Another advantage of this double-purpose instrument is that the vacuum can be used to keep the operating field free from obstructing hemorrhages dur-

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* Manufactured by Storz Instrument Co., 4570 Audubon Ave., St. Louis 10, Mo.

ing a dacryocystorhinostomy operation.

An instrument to serve the double purpose of suction for cataract extraction and dacryocystorhinostomy was first designed by Dr. Castañeda from Spain.* I believe this new instrument has been made more economical without losing efficiency and has been simplified still further than the one made in Spain.

The unit is compact, measuring 3.5 by 9.75 inches; the carrying case is 6.25 by 5.5 by 9 inches; the weight of the instrument including the flexible shaft and dental handle is 8 pounds; the weight of the carrying case, 2.5 pounds.

* Personal communication.

NEW DOUBLE-BLADED KNIFE FOR KERATOPLASTY AND OTHER SURGICAL PROCEDURES

RAMÓN CASTROVIEJO, M.D.
NEW YORK, N. Y.

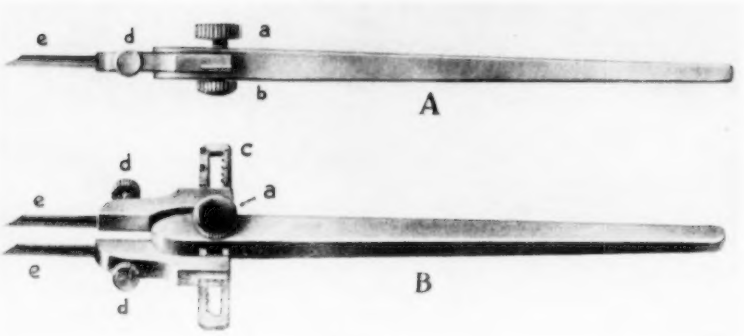

FIGURE 1.

IN 1932, in an article on keratoplasty, I described a double-bladed knife.[1] The instrument, provided with very sharp twin blades made of razor blade material, was used to perform square keratoplasties. The blades were fastened to the instrument by means of screws and the distance separating the blades could be adjusted to transplants of different sizes. The size of the graft was measured with a ruler marked in millimeters. The tightening of the screws which fastened the blades in position and of those of the blade carriers had to be adjusted with the aid of a screwdriver.

In 1941, the double-bladed knife was modified, incorporating hand manipulated screws into the instrument which permitted the adjustment of the instrument to different sizes of transplants without employing a screwdriver. The screwdriver was needed only to fasten the blades into position, and the ruler was still necessary to measure the distance between the blades.

The new instrument presented now (fig. 1, A and B) has been improved still further to simplify its handling.* The

From the Institute of Ophthalmology, Columbia Presbyterian Medical Center, New York.

Presented as a *New Instrument* at the Fifty-Sixth Annual Session of the American Academy of Ophthalmology and Otolaryngology, Oct. 14-19, 1951, Chicago, Ill.

* Manufactured by E. B. Meyrowitz Surgical Instrument Co., Inc., 520 Fifth Ave., New York.

blades (e) are fastened to the blade carriers by the thumb screws (d). The adjustment of the distance between the blades is easily accomplished by a rack and pinion arrangement (b and c) which controls the adjustment of the blade carriers to different distances, and a thumb screw (a) which locks the blade carriers into position. In addition, a graduated scale in millimeters (c) has been incorporated into the instrument which measures the distance between the blades.

The instrument has been found useful also for keratoplasties whenever flaps of different lengths and even widths have to be made, such as in scleral resection for retinal detachments, as well as in some plastic operations in skin and mucosa.

REFERENCE

1. Castroviejo, Ramon: Keratoplasty: an historical and experimental study, including a new method, Am. J. Ophth., 15:906-907 (Oct.) 1932.

A ONE-HANDED, SELF-RETRACTING ANTERIOR CHAMBER ASPIRATION SYRINGE

THEODORE BISLAND, M.D.
WASHINGTON, D. C.
BY INVITATION

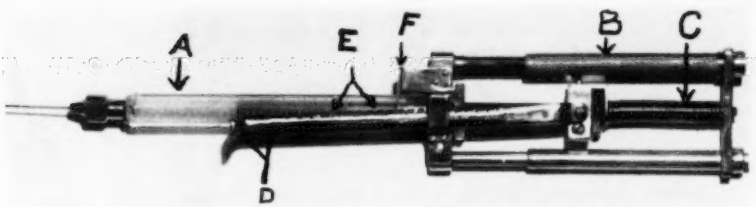

FIG. 1.—A one-handed, self-retracting anterior chamber aspiration syringe. The basic unit is a tuberculin syringe (A) with an added superstructure. The spring (C) retracts the plunger of the syringe. The knurled screw (B) varies the maximum stroke of the plunger. The rate of aspiration and the amount of fluid withdrawn can be very closely regulated by means of the thumb control lever (D). The syringe balances nicely in the hand, and once the desired quantity has been extracted, the plunger is locked at that point by means of the notches (E) and cog (F).

IN carrying out some investigative work on the aqueous, it became apparent that an aspiration syringe which could be safely and efficiently operated with one hand would be of great help. Such a syringe was designed and, after several prototypes, the instrument illustrated here was made (fig. 1).

From Gallinger Municipal Hospital, Washington, D. C.

Presented as a *New Instrument* at the Fifty-Sixth Annual Session of the American Academy of Ophthalmology and Otolaryngology, Oct. 14-19, 1951, Chicago, Ill.

The basic unit is a tuberculin syringe with an added superstructure which permits accurate and efficient aspiration using only one hand.

This syringe accomplishes several things: (1) it frees the other hand of the operator for fixation prior to and during aspiration; (2) it permits aspiration at any desired rate; (3) it locks the plunger after any desired quantity has been extracted, thus preventing accidental loss of fluid from syringe; (4) it greatly reduces the chance of ac-

cidental lens injury since fixation, entry into the anterior chamber and aspiration are all under control of the operator; and (5) it requires only one person for safe anterior chamber puncture.

It is hoped that this syringe will facilitate further and elucidating work on intraocular fluids in pathological and physiological states in the intact animal eye and the human eye.

THIN-WALLED NEEDLES FOR STENOSIS OF THE LOWER CANALICULUS AND NASOLACRIMAL DUCT

EVERETT R. VEIRS, M.D.
TEMPLE, TEXAS

A SPECIAL thin-walled, 16- or 18-gauge needle has been designed for use in cases of partial and complete stenosis of the lower canaliculus, and complete stenosis of the nasolacrimal duct.* The needle is made with either a sharp or blunted end (fig. 1). It is 1½ or 2½ inches in length, has an extremely thin wall, and is made of malleable steel. The blunted-end needle is curved so that it can be passed through the nasolacrimal duct more easily. Both needles are used with the stylet in place.

In a patient with a blocked nasolacrimal duct (chronic dacryocystitis is usually present), the lower canaliculus is dilated with a suitable lacrimal dilator. The needle is inserted into the tear sac through the lower canaliculus, with the stylet in place. It is then passed through the nasolacrimal duct into the nose. Polyethylene tubing, .965 mm., is threaded through the 18-gauge needle and the needle is withdrawn. The tubing is left in place, strapped to the cheek, for about one week. In cases where the lower canaliculus only is partially stenosed, the needle and tubing are passed only into the tear sac. If a 16-gauge, thin-walled needle is used, polyethylene tubing with an outside diameter of 1.27 mm. is the proper size.

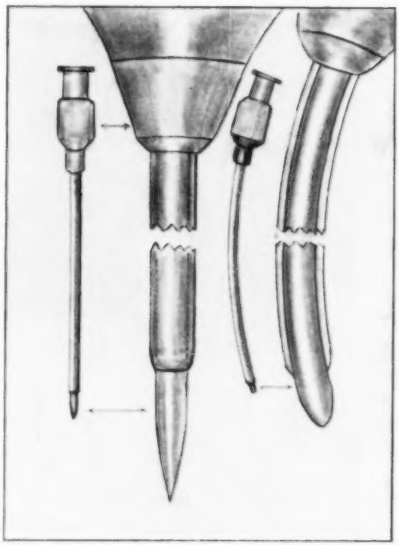

FIG. 1—Detail drawing of thin-walled needles for use in cases of stenosis of the lower canaliculus and nasolacrimal duct.

The same needle with a very sharp point is used to insert polyethylene tubing in cases of complete stenosis of the lower canaliculus; that is, where an entirely new channel must be made.

From the department of ophthalmology and otolaryngology, Scott and White Clinic.

* These needles, B-D Special Needle No. T462LNR, are manufactured by Becton, Dickinson and Company, Rutherford, New Jersey.

Presented as a *New Instrument* at the Fifty-Sixth Annual Session of the American Academy of Ophthalmology and Otolaryngology, Oct. 14-19, 1951, Chicago, Ill.

A NEW ERESIPHAKE TIP

EVERETT R. VEIRS, M.D.
TEMPLE, TEXAS

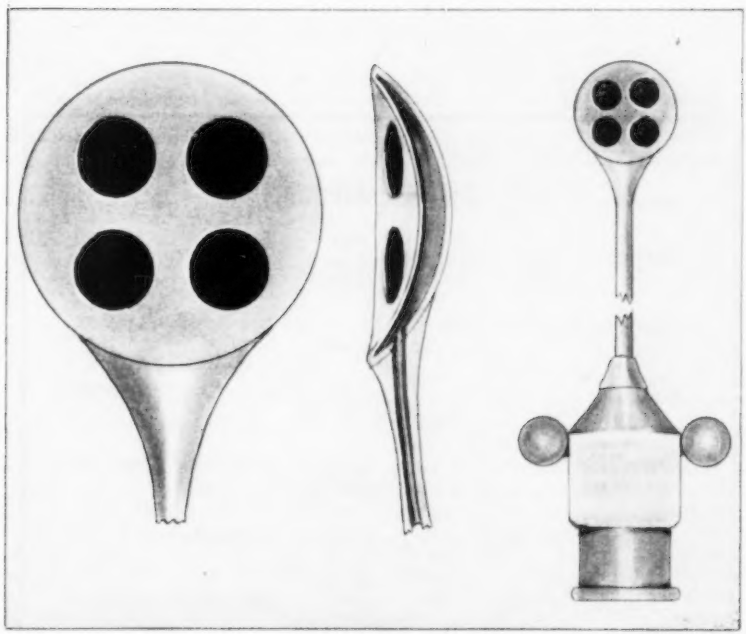

FIG. 1—Detail drawing of a new eresiphake tip with four openings.

AN eresiphake tip has been designed to eliminate some of the objections to the single-opening eresiphake tip. In 1949 I reported a new eresiphake tip,[1] but since then I have found that a tip with four openings* is superior to one with a larger number of openings. The lens capsule is seldom broken with this type of tip. With a single-opening tip, rupture of the capsule due to cutting of the capsule on the sharp inner edge of the eresiphake tip seems to occur not infrequently. Also, the lens capsule seems at times to rupture because of excess deforming of the lens as it is drawn up into the cup of the single-opening tip. Some deforming of the lens seems desirable in helping to break the zonules, but excess deforming may break the capsule.

The tip is used with motor suction; the Nugent type of motor suction machine seems best.

From the department of ophthalmology and otolaryngology, Scott and White Clinic.

Presented as a *New Instrument* at the Fifty-Sixth Annual Session of the American Academy of Ophthalmology and Otolaryngology, Oct. 14-19, 1951, Chicago, Ill.

* This instrument is manufactured by V. Mueller and Company, 330 S. Honore St., Chicago, 12.

REFERENCE

1. Veirs, Everett R.: The use of eresiphake in cataract extraction, South. M. J., 42:392-395 (May) 1949.

In Memoriam

Charles Herndon Haralson.....Tulsa, Oklahoma
October 29, 1952

James Gilliam Johnston.....Charlotte, North Carolina
October 6, 1952

Paul Lux.....Kansas City, Missouri
September 20, 1952

William J. Marshall.....Missoula, Montana
September 23, 1952

Leroy L. Sawyer, Jr.....Washington, D. C.

John Joseph Shea.....Memphis, Tennessee
November 28, 1952

George Hull Shuman.....Pittsburgh, Pennsylvania
September 3, 1952

Earle Terry Smith.....West Hartford, Connecticut
July 23, 1952

TRANSACTIONS

American Academy of Ophthalmology and Otolaryngology

Official Publication of the American Academy of Ophthalmology and Otolaryngology

Published under the direction of the Editorial Board

WILLIAM L. BENEDICT, Rochester, Minnesota, *Editor*

W. HOWARD MORRISON, Omaha, Nebraska, *Associate Editor*

HENRY L. WILLIAMS, Rochester, Minnesota, *Associate Editor*

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All communications regarding the TRANSACTIONS should be addressed to William L. Benedict, M.D., Executive Secretary-Treasurer, American Academy of Ophthalmology and Otolaryngology, 100 First Avenue Building, Rochester, Minnesota

COUNCIL MINUTES

FIFTY-SEVENTH ANNUAL SESSION

October 11, 1952
Palmer House, Chicago

Present:

James Milton Robb, Frederick C. Cordes, Georgiana Dvorak Theobald, Percy E. Ireland, John S. McGavic, Conrad Berens, J. Mackenzie Brown, Derrick Vail, William L. Benedict, Kenneth L. Roper, Howard P. House, A. D. Ruedemann, Dean M. Lierle, Lawrence R. Boies, Erling W. Hansen, Archie D. McCannel, C. Stewart Nash, John H. Dunnington, Francis E. LeJeune.

The meeting was called to order at 9:00 a.m. by Dr. James Milton Robb, President.

I

The Executive Secretary, Dr. William L. Benedict, reported on the membership as follows:

1. *Fellowship* (as of October 1, 1952):

Junior	4,377
Senior	189
Life	417
Honorary	26
	5,009

2. *Candidates*:

Complete	392
Incomplete	3
	395

3. *Elevations to Senior Fellowship on January 1, 1953.*

Adams, Charles Joseph ..... Kokomo, Ind.
Allen, Orris T. ..... Terre Haute, Ind.
Allen, Thomas Dyer ..... Chicago, Ill.
Alvis, Bennett Y. ..... St. Louis, Mo.
Blair, Mortimer Warren .... Philadelphia, Pa.
Brownell, Morton Emmons .... Wichita, Kan.
Bryan, James Leslie ..... Nashville, Tenn.
Bulson, Eugene Loring ..... Ft. Wayne, Ind.
Carruth, Howard Ernest ..... Portland, Ore.
Cassady, J. Vernal ..... South Bend, Ind.
Christoph, Carl H. ..... Chicago, Ill.
Cody, Claude Carr, Jr. ..... Houston, Texas
Cowan, Alfred ..... Philadelphia, Pa.
Crumrine, Norman R. ..... Beaver, Pa.
Cunning, Daniel S. ..... New York, N. Y.
Davis, John Calvin, Jr. ..... Omaha, Neb.
Deal, John Francis ..... Springfield, Ill.
DeWitt, Edward Nicholas .. Bridgeport, Conn.
Dixon, Otto Jason ..... Kansas City, Mo.
Eber, Carl Theodore ..... St. Louis, Mo.
Eimer, Charles Eugene ..... St. Louis, Mo.
Ellis, C. Ward ..... West Olive, Mich.
Fernlund, George Byron ... New York, N. Y.
Folken, Frank Garrett .... Albert Lea, Minn.
Ford, Hanby Lewis ..... Champaign, Ill.
Fuchs, Valentine Henry ... New Orleans, La.
Gaudet, Lucien Sydney ..... Natchez, Miss.
Glick, Harry Naylor ..... St. Louis, Mo.
Glowacki, Ben Francis ..... Detroit, Mich.
Goldman, A. Milton ..... Rockville Centre, L. I., N. Y.
Greene, Laurence Whitridge .. Denver, Colo.
Greenfield, William John .. Hackensack, N. J.
Hale, Arthur Stanley ..... Detroit, Mich.
Hall, Edwin Perry ..... Oneonta, N. Y.

Some items are omitted from this report. Complete minutes are on file in the office of the Executive Secretary-Treasurer.

Hardy, LeGrand Haven ....New York, N. Y.
Harrison, Fred Hazard....Connellsville, Pa.
Hill, Frederick Thayer ....Waterville, Maine
Hill, Howard Foster .....Waterville, Maine
Howard, Harvey James ....Clearwater, Fla.
Hughes, Ray Whitbeck ....Lake Worth, Fla.
Jackson, Atras Earl .....Ft. Worth, Texas
Jones, Cecil Cain .....Des Moines, Iowa
Jones, Edley Hicks .....Vicksburg, Miss.
Jones, Vincent L. .....St. Louis, Mo.
Karkeet, Robert B. .....Portland, Ore.
Kelley, Isaac D., Jr. .....St. Louis, Mo.
Kelly, Joseph Dominic ....New York, N. Y.
Kennedy, Eldred Weston ..Rochester, N. Y.
Kincannon, LeRoy Taylor ..Birmingham, Ala.
Koenig, Ivan J. .....Buffalo, N. Y.
Krimsky, Joseph .....Huntington, W. Va.
Kuhn, Hugh A. .....Hammond, Ind.
Lawwill, Stewart .....Chattanooga, Tenn.
Lewis, Philip Meriwether ..Memphis, Tenn.
Lierle, Dean M. .....Iowa City, Iowa
Lucas, Harold Roy .....Portland, Ore.
Lupton, Irving Martin .....Portland, Ore.
Mahoney, Paul Leo .....Little Rock, Ark.
Mason, Roy Earl .....St. Louis, Mo.
Masters, Robert John .....Indianapolis, Ind.
McKee, Joseph Wallace ....Kansas City, Mo.
McNally, William James, Montreal, Que., Can.
Merkel, Charles Carson, Grosse Pointe, Mich.
Meyer, Samuel James .....Chicago, Ill.
Montgomery, Daniel Cameron ....Greenville, Miss.
Moriarty, Richard W. ..White Plains, N. Y.
Palmer, Bascom Headen .....Miami, Fla.
Palmer, Frank Ernest .....Sterling, Colo.
Plumer, John Shaffer .....Pittsburgh, Pa.
Powell, Lyle Stephenson ....San Diego, Calif.
Randall, Hiram .....Binghamton, N. Y.
Reese, Algernon B. .....New York, N. Y.
Rhode, Solon Lafayette, Santa Barbara, Calif.
Risser, Edward D. .....Pasadena, Calif.
Rychener, Ralph Orlando ....Memphis, Tenn.
Sanor, Daniel Galbreath ....Columbus, Ohio
Savery, Charles Edward ....South Bend, Ind.
Sinamark, Andrew .....Hibbing, Minn.
Spaeth, Edmund B. .....Philadelphia, Pa.
Spencer, George Albert ..Pacific Grove, Calif.
Sproule, Ralph P. .....Milwaukee, Wis.
Steele, Willard .....Chattanooga, Tenn.
Stinson, William David .....Memphis, Tenn.
Swab, Charles Marion .....Omaha, Neb.
Teall, Raymond Edwin ....Kansas City, Mo.
Thompson, Howard E. .....Dubuque, Iowa
Warren, William C., Jr. .....Atlanta, Ga.
Weber, Henry Charles .....Drexel Hill, Pa.
Whalen, Edward Joseph ....Hartford, Conn.
Willson, Wesley W., North Hollywood, Calif.
Windham, Robert Edward, San Angelo, Texas
Wood, Earl LeRoy .....Newark, N. J.
Woodson, Burbank Palmer ....Austin, Texas
Zubak, Matthew Francis ..Wheeling, W. Va.

4. *Elevations to Life Fellowship on January 1, 1953:*

Annon, Walter Thomas ....Philadelphia, Pa.
Blassingame, Charles Decatur, Memphis, Tenn.
Bozer, Herrmann Eugene .....Buffalo, N. Y.
Bruner, Abram Breneman ..Cleveland, Ohio
Clerf, Louis Henry .....Philadelphia, Pa.
Dean, Alfred .....Grand Rapids, Mich.
Dorge, Richard Irving ....Minneapolis, Minn.
Gill, G. Bache .....Washington, D. C.
Goldman, Harry G. .....New York, N. Y.
Harris, Robin .....Jackson, Miss.
Hetrick, Llewellyn Evans ....Hampton, Conn.
Howard, Lloyd G. .....Council Bluffs, Iowa
Johnson, Thomas Holland ..New York, N. Y.
Lerner, Macy Levi .....Rochester, N. Y.
Looper, Edward Anderson ....Baltimore, Md.
Lyman, Harry W. .....St. Louis, Mo.
McKinney, Alexander R. ....Saginaw, Mich.
Myerson, Mervin Carueth, Beverly Hills, Calif.
Parrish, Robert Eunice ..San Antonio, Texas
Proetz, Arthur Walter .....St. Louis, Mo.
Somberg, Joseph Sheldon ....Oakland, Calif.
Tomassene, Raymond A. ...Wheeling, W. Va.
Townsend, John Ferrars ....Charleston, S. C.
Tucker, Gabriel .....Philadelphia, Pa.
Wendel, Jacob S. .....Detroit, Mich.
Winter, John Arthur .....Duluth, Minn.

5. *Deaths Reported Since Last Council Meeting:*

Allis, Paul Mitten .....Lewistown, Pa.
Andrews, Malcolm P. .....Manitowoc, Wis.
Bailey, Harold .....Charles City, Iowa
Bass, Albert Leonard .....Louisville, Ky.
Blankfeld, Nathan .....Brooklyn, N. Y.
Boice, Ralph Edwin .....Toledo, Ohio
Brown, Clyde Olin .....St. Louis, Mo.
Brown, Earl Henderson, Jr. ....Tucson, Ariz.
Brumm, Seth Arthur .....Pottsville, Pa.
Buck, Clair Aurelius .....Glen Falls, N. Y.
Clothier, Joseph V. .....Pocatello, Idaho
Crisp, William Henry .....Denver, Colo.
Daily, Louis .....Houston, Texas
Davies, Morgan Cryder ....Columbus, Ohio
Davis, Thomas W. ....Winston-Salem, N. C.
Emerson, Linn .....Orange, N. J.
Evans, Samuel Davidson .....Pittsburgh, Pa.
Firestone, Charles .....Seattle, Wash.
Fisher, George Garthwaite ....Newhall, Calif.
Fletcher, Harold Augustus ..Kentfield, Calif.
Gill, William Davis .....Dallas, Texas
Gorrell, Talbot John H. ..Chicago Heights, Ill.

Gottlieb, Bernard Norman ....Brooklyn, N. Y.
Grossman, Herman Paul ....Providence, R. I.
Guggenheim, Louis Kaufman ...Los Angeles, Calif.
Gundelach, Charles Armin ....St. Louis, Mo.
Hageman, George Ricker ....Longmont, Colo.
Halsted, Frederick Smith .....Denver, Colo.
Haney, William Porter .....Omaha, Neb.
Harvey, Norman Darrell .....Pelham, N. Y.
Jones, Marvin Fisher .....New York, N. Y.
Kennedy, William Aloysius ..St. Paul, Minn.
LaForce, Edward Francis ..Burlington, Iowa
Lancaster, Walter Brackett ....Boston, Mass.
Lauber, Hans .....Salzburg, Austria
Lombardo, Melchiore .....Brooklyn, N. Y.
Luedde, William Henry .....St. Louis, Mo.
Marshall, George Guerin .....Rutland, Vt.
Marshall, Hal Ellsworth .....Wichita, Kan.
McCullough, Malcolm Kelley ..Dallas, Texas
McDiarmid, H. Oliver .....Brandon, Man., Canada
McDonald, Carl Lenz .....Cleveland, Ohio
McKey, Earle Sinclair, Jr. ....Valdosta, Ga.
Monahan, John Ambrose .....Clinton, Mass.
Morman, William Daniel .....St. Louis, Mo.
Morrison, Frederick McCullough ..Lynchburg, Va.
Moulton, Everett C., Sr. ..Fort Smith, Ark.
Mussun, William G. .....Cleveland, Ohio
Overman, Frederick Vaile .....Tipton, Ind.
Paton, Walter Mudie .....Vancouver, B. C., Canada
Peden, Barton Edward .....Seattle, Wash.
Pfunder, Malcolm Chester, Minneapolis, Minn.
Ralston, William Wallace ....Houston, Texas
Riesenbeck, Leo H. .....Miami, Fla.
Riser, Roy Otis .....Park Ridge, Ill.
Rosenbaum, Jacob ....Montreal, Que., Canada
Ryder, Delano Richmond ..Barrington, R. I.
Sauer, William Walter .....Marietta, Ohio
Schmidt, James McMahon ....Carmel, N. Y.
Schmidt, Otto Victor Mackenty ..New York N. Y.
Schwartz, Alfred Alexander, New York, N. Y.
Scobee, Richard Gordon .....St. Louis, Mo.
Sheahan, William Lawrence ....New Haven, Conn.
Stelle, Harry L. .....Pittsburg, Kan.
Stevenson, Walter Davis .....Quincy, Ill.
Stine, George Haeberle ....Colorado Springs, Colo.
Stoll, Karl Ludwig .....Cincinnati, Ohio
Sutherland, William Sassman ..Philadelphia, Pa.
Tickle, Thomas Gooch ....New York, N. Y.
Tingley, Louisa Paine .....Providence, R. I.
Uhler, Stewart Mann .....Allentown, Pa.
Upham, Helen Frances ..Asbury Park, N. Y.
van der Hoeve, J. .....Leiden, Holland
Watson, Henry DeWitt ..Binghamton, N. Y.
White, Vivian Parley ..Salt Lake City, Utah
Wilson, James Sharp .....Canton, Ohio
Woods, Ralph Hueston .....La Salle, Ill.
Zemer, Stanley Gillum .....Lincoln, Neb.

6. Six Fellows, for various reasons, have tendered their resignations to the Academy.
7. Nine Fellows have requested that their status be changed to that of Inactive Fellow.

Dr. Benedict further reported that early in the year the Council was asked to vote by mail on the "Continental Plan of Association Group Insurance" designed especially for this society by Life Associates, Inc. and submitted to the Council on January 21, 1952.

On April 4, 1952, President James Milton Robb declared that the vote of the Council was favorable to the adoption of the Plan. of the Plan, and on April 18, 1952, he signed the application on behalf of the Academy.

II

The Treasurer, Dr. Benedict, submitted the audit for 1951, made by Byers, Wobschall & Miller, Certified Public Accountants, and the financial status of the Academy as of September 30, 1952. It was moved and seconded that the report be accepted. The motion carried. (*The audit for* 1951 *appeared in the May-June* 1952 *issue of the* TRANSACTIONS. *The financial status of the Academy as of September* 30, 1952, *is published herewith.*)

EXHIBIT "A"

AMERICAN ACADEMY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY

Balance Sheet as of September 30, 1952

ASSETS

Current Assets:			
Cash on Hand		$ 25.00	
Cash in banks:			
First National Bank of Rochester		19,971.64	
First National Bank of Minneapolis		4,835.44	
Bank of Montreal, Toronto, Canada		2,036.17	
Checks for Collection		30.00	
Accounts Receivable:			
Abstracts, Manuals, Etc.	$ 514.35		
Advertisers	483.25		
Delinquent Membership Dues	804.00	1,801.60	
Inventories:			
Abstracts, Manuals, Etc.	$12,437.85		
Embryology of the Eye Film	225.00		
Embryology of the Eye Filmstrips and Slides	3,567.50	16,230.35	
Total current assets			$ 44,930.20
Investments:			
Educational Fund		$221,507.23	
Wherry Memorial Lecture Fund		4,600.00	
		$226,107.23	
Plus: Advance in Market Values—Dec. 31, 1951		1,616.03	227,723.26
Fixed Assets:			
Furniture and Fixtures	$ 8,581.88		
Less: Reserve for Depreciation	4,921.17	$ 3,660.71	
Embryology of Eye Motion Picture Film and Slides	$40,900.00		
Less: Reserve for Depreciation	10,820.00	30,080.00	33,740.71
Deferred Charges:			
Prepaid Expenses		$ 75.00	
Prepaid Insurance		480.15	
Prepaid Postage		269.63	
Embryology of Human Ear Motion Picture		21,666.67	22,492.10
Total Assets			$328,886.27

LIABILITIES AND NET WORTH

Current Liabilities:			
Accrued Expenses		$ 8.58	
Accrued Withholding Tax		601.45	
Deferred Income:			
Advance payments: Membership Dues		203.00	
Advance payments: 1952 Bound Volumes		2,395.00	$ 3,208.03
Undisbursed Funds from Special Contributions:			
Economic Survey on Impaired Hearing		$ 112.88	
Wherry Memorial Lecture Fund		5,152.72	
Isabelle Wilson Fund		25.00	5,290.60
Net Worth:			
Surplus—January 1, 1952		$298,138.35	
Excess Income over Expenses—Year to Date		22,249.29	320,387.64
Total Liabilities and Net Worth			$328,886.27

EXHIBIT "B"

AMERICAN ACADEMY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY

Statement of Income and Expenses
For the Month Ending September 30, 1952 and Year to Date

	September 1952	1/1/52 to 9/30/52
Revenues:		
Membership Dues	$ 49.00	$ 30,240.00
Membership Applications	640.00	6,400.00
Abstracts, Manuals and Monographs	1,155.75	4,001.75
Film—Embryology of the Eye	500.00	2,000.00
Filmstrips and Slides—Embryology of the Eye		450.00
Standardization of Tonometers	20.00	1,061.00
Other Income		22.00
Convention	14,402.00	55,473.50
Educational Fund:		
Interest	387.50	3,826.36
Dividends	51.00	1,363.98
Home Study	1,290.00	6,332.00
TRANSACTIONS	3,729.55	41,922.64
Total Revenues	$22,224.80	$153,093.23
Operating Expenses:		
General and Administrative	$ 5,041.18	$ 47,202.37
Convention and Meetings	2,610.65	11,259.43
Home Study	646.89	5,705.95
TRANSACTIONS	7,673.71	63,249.30
Educational Fund	340.00	3,426.89
Total Operating Expenses	$16,312.43	$130,843.94
Excess Income Over Expenses	$ 5,912.37	$ 22,249.29

American Academy of Ophthalmology and Otolaryngology

Securities Owned as of September 30, 1952

EDUCATIONAL FUND

BONDS	RATE %	MATURITY	PAR VALUE	COST
Citizens Bldg. Co. of Cleveland, 1st Leasehold Sinking Fund	6	1/ 1/46	$ 5,000.00	$ 5,000.00
Van Sweringen Co., Certificates of Indebtedness	6	12/31/48	3,445.70	3,477.03
Dominion of Canada—Series P5	3	10/ 1/63	5,000.00	5,112.50
Dominion of Canada—Series P5	3	10/ 1/63	2,500.00	2,500.00
U. S. Savings Bonds—Series F	2½	12/ 1/55	13,500.00	9,990.00
U. S. Savings Bonds—Series G	2½	8/ 1/53	10,000.00	10,000.00
U. S. Savings Bonds—Series G	2½	6/ 1/55	4,000.00	4,000.00
U. S. Savings Bonds—Series G	2½	3/ 1/56	6,000.00	6,000.00
U. S. Savings Bonds—Series G	2½	5/ 1/56	8,000.00	8,000.00
U. S. Savings Bonds—Series G	2½	7/ 1/56	2,000.00	2,000.00
U. S. Savings Bonds—Series G	2½	11/ 1/56	25,000.00	25,000.00
U. S. Savings Bonds—Series G	2½	1/ 1/57	2,000.00	2,000.00
U. S. Savings Bonds—Series G	2½	7/ 1/58	30,000.00	30,000.00
U. S. Savings Bonds—Series G	2½	12/ 1/58	25,000.00	25,000.00
U. S. Savings Bonds—Series G	2½	3/ 1/59	15,000.00	15,000.00
U. S. Treasury Bonds—1966-71	2½	3/15/71	10,000.00	10,087.50
U. S. Savings Bonds—Series G	2½	7/ 1/60	30,000.00	30,000.00
Total Bonds				$193,167.03

STOCKS	KIND	PAR VALUE	SHARES	
Citizens Bldg. Co. of Cleveland	Shares	No Par	50	None
Commonwealth Edison Company	Common	$25.00	100	$ 2,619.00
E. I. duPont de Nemours & Company	Common	5.00	60	2,347.31
Louisville Gas & Electric Company	5% Preferred	25.00	200	5,450.00
Massachusetts Investors Trust	Trust Cert.	1.00	617	17,923.89
Ophthalmic Publishing Company	Capital	20.00	5	None
Total Stocks				$ 28,340.20
Total—Educational Fund			(A)	$221,507.23

WHERRY MEMORIAL FUND

	RATE %	MATURITY	PAR VALUE	
U. S. Savings Bonds—Series G (B)	2½	1955	$4,600.00	$ 4,600.00
				$226,107.23
Increase in Market Values as of December, 1951				1,616.03
TOTAL SECURITIES				$227,723.26

(A) Held for safekeeping by Trust Dept., First National Bank, Minneapolis, Minn.
(B) Held by Dr. W. L. Benedict, Executive Secretary-Treasurer, Rochester, Minn.

III

The report of the Editor of the TRANSACTIONS was read by Dr. Benedict, Editor-in-Chief, as follows:

For the period September 1, 1951, through August 31, 1952, an average of 6,539 copies of the TRANSACTIONS was printed bimonthly. Of these, 675 were set aside for bound volumes and an average of 5,807 was mailed, an increase in circulation of 261 over last year. The following categories are represented:

Fellows	5,015
Candidates	172
Subscribers	377
Libraries	108
Exchange & Miscellaneous	53
Advertisers & Agents	53
Complimentary	34
Single copies	57

Four hundred and seventy-nine orders for the 1952 bound volumes have been received to date.

The average number of pages of paid advertising was 24.33 representing 36 advertisers.

The *revenue* from the TRANSACTIONS was as follows:

Amount set aside from Fellows' dues	$22,950.00
Amount set aside from Candidates' fees	1,825.00
Subscribers (nonmembers)	3,359.00
Bound Volumes	2,983.50
Single issues sold	127.00
Reprints	1,131.15
Advertisers	12,649.86
Cuts (loaned)	91.11
Directory	27.00
American Orthoptic Journal	150.00
Total	$45,293.62

The *expenditures* for the TRANSACTIONS were as follows:

Printing bimonthly issues	$26,555.73
Binding Bound Volumes	1,180.25
Cuts and engravings	15,629.38
Postage	1,096.77
Reprints	1,850.30
Directory	3,234.00
Salaries	7,050.00
Supplies (stock, envelopes, etc.)	9,118.93
General Expense	55.39
Cash Discounts Allowed	223.60
Total	$65,994.35
Deficit	$20,700.73

All material formerly in supplements is now included in regular issues with the exception of the *American Orthoptic Journal*. This material includes papers read at the special scientific programs of the Otosclerosis Study Group, the Committee on Conservation of Hearing and the Otosclerosis Study Group, the Teachers' Sections of Ophthalmology and Otolaryngology, and the American Society of Ophthalmologic and Otolaryngologic Allergy. The papers on the program presented by the Joint Committee on Industrial Ophthalmology appear as usual in the Industrial Ophthalmology Section of the TRANSACTIONS. Largely as a result of this change, paging has increased from 710 pages of scientific material in the period from September 1, 1950 to August 31, 1951 to 909 in a similar period ending August 31, 1952. During the same periods we ran 262 and 290 pages respectively of advertising, news notes, society directory and other material not included in the bound volumes.

The second issue of the *American Orthoptic Journal*, which is issued as a supplement to the TRANSACTIONS, containing papers read at the special program of the American Orthoptic Council and the American Association of Orthoptic Technicians, as well as selected papers read at regional meetings and other pertinent material, has been mailed to our members and subscribers and, as a separate, to about 100 members of the American Association of Orthoptic Technicians. This issue was planned by Dr. Richard Scobee and was dedicated to Dr. Walter Lancaster. Dr. Scobee had just completed his work on the Journal at the time of his death. An editor has not yet been chosen to replace him.

During the past year the Academy has published two manuals and two monographs.

Manuals

May, 1952—Becker, Principles of Otolaryngic Plastic Surgery

September, 1952—Snydacker, Refraction

Monographs

May, 1952—Manual for a School Hearing Conservation Program

June, 1952—Hoople et al., Helpful Hints for Handling the Hearing Handicapped

A motion to accept the report of the Editor-in-Chief was made by Dr. John Dunnington. The motion was seconded by Dr. Derrick Vail and carried.

IV

Old Business

Dr. Benedict read again a recommendation to change Article III of the Constitution. This change had been approved by the Council and the Business Meeting at the 1951 annual meeting of the Academy and had been duly published in the November-December issue of the TRANSACTIONS, which was sent to all Fellows of the Academy.

Article III, now headed "Fellowship," should be entitled "Members and Fellows."

The first paragraph of Article II, Section (a), under "Active Fellowship," now reads as follows:

"A candidate for Active Fellowship shall be a member in good standing of his or her local, county, state and/or national medical society and must be certificated and approved by the American Board of Ophthalmology, the American Board of Otolaryngology or the American Board of Plastic Surgery. When a candidate is elected to Fellowship in the Academy, he shall be classified in the Directory of the Academy as practicing the specialty or specialties for which he holds a Board certificate."

It is recommended that this be changed to read:

"A candidate for Active Fellowship shall be a member in good standing of his or her local and national medical society and must be certificated and approved by a national examining and certifying specialty Board acceptable to the Council."

A motion was made by Dr. Conrad Berens, seconded by Dr. Dean M. Lierle, that these revisions of the Constitution be granted final approval by the Council. The motion carried.

V

Communications

1. Dr. Benedict read a letter from Miss Yetta Lauber of Vienna, Austria, regarding a bequest to the Academy by her father, the late Professor Hans Lauber, an Honorary Fellow of the Academy since 1934. The bequest is a portrait of Professor Lauber's venerated teacher, Isidor Schnabel. The portrait will be brought to this country by Dr. James Huston, a Fellow of the Academy who is now studying in Vienna.

2. Letters were read from Dr. G. A. Brew and Dr. A. L. Lance, president and secretary respectively of the Ophthalmological Society of Australia, thanking the Academy for the gift of a print of the Academy film, "The Embryology of the Eye," which was presented to the Society on behalf of the Academy by Dr. Algernon B. Reese on August 25, 1952.

3. On September 2, 1952, an invitation was received from the Trustees and Faculty of Meharry Medical College to send a delegate to the ceremonies marking the inauguration of Harold Dadford West as the fifth president of the College in Nashville on October 20, 1952.

A letter was written to Dr. John T. Bryan, a Fellow of the Academy living in Nashville, requesting him to serve as the delegate of the Academy at this ceremony. Dr. Bryan has kindly consented to perform this service.

4. Dr. Thomas D. Allen, Secretary-General for North America of the Pan-American Association of Ophthalmology, requested that the Academy appoint a member to serve on the Program Committee for the Fifth Congress of the Pan-American Association of Ophthalmology, to be held in Santiago, Chile, early in 1956. He suggested the name of Dr. Conrad Berens and asked for permission to invite Dr. Berens to serve on the Committee. His request was approved and permission granted.

Dr. Allen also requested that the Academy take some action regarding the appointment of a delegate from the United States to serve on the Council of the Fifth Pan-American Congress on Ophthalmology, such a delegate to represent the Academy, the American Ophthalmological Society, and the Section on Ophthalmology of the American Medical Association. The matter was referred to the Executive Committee.

6. On July 12, 1952, Dr. L. Byerly Holt, Medical Adviser of the Eye Bank for Restoring Sight, Inc., sent to the Academy office copies of the North Carolina Assembly Act in Regard to Eye Banks, the Certificate of Incorporation, a pamphlet prepared by the lay organization explaining the services of the Eye Bank, and a form used for persons wishing to donate their eyes after death. He stated: "If there are any changes which . . . the Academy . . . would wish to make in regard to the Eye Bank, we will be glad to make these."

The Council felt that this matter was not within the province of the Academy.

7. On July 1, 1952, Dr. Frederick H. Theodore of New York City wrote regarding the advisability of the Academy appointing a Committee to further the campaign already in progress to regulate the preparation of sterile ophthalmic solutions. He enclosed copies of articles and correspondence regarding such sterilization. The request was referred to the Executive Committee.

8. A letter from Dr. Alan C. Woods dated October 1, 1952, suggested that the Council of the Academy might well take some action regarding the impropriety in a scientific paper of a footnote such as one appearing in the article on "The Nonsurgical Treatment of Cataract" by R. F. Shropshire, Jacob R. Ginsberg and Mendel Jacobi in *Science*, September 12, 1952. The footnote read: "The patients were treated at the office of Dr. Ginsberg, 705 New Jersey Avenue, Brooklyn, New York."

The Council authorized the Executive Secretary-Treasurer to send a letter to the Editor of *Science* protesting such a procedure.

9. A communication was also read from the Trustees of the Association for Research in Ophthalmology condemning the premature release of information regarding a questionable medical treatment for cataract. In addition, the Trustees of the Association stated that they had appointed a representative, Dr. David Cogan, to serve on a joint committee to investigate the various implications of the article in *Science* magazine on this subject, and requested that the Council of the Academy consider a similar action. The request was referred to the Executive Committee.

10. Under date of October 1, 1952, Dr. W. W. Wilkerson, Jr., Nashville, Tennessee, stated in a letter to the Executive Secretary-Treasurer that he felt the Council of the Academy might well take steps in cooperation with other organizations to the end that Audiologists would be certified through a certification board.

The recommendation was referred to the Committee on Conservation of Hearing.

12. Dr. J. M. Robb, President, read a letter from Dr. Frank Turchik, dated October 27, 1951, recommending that the Academy appoint a Committee on the Conservation of Voice. The letter was referred to the Executive Committee for consideration.

13. A communication from Dr. Bernard N. Friedman proposed that a change be made in the rules of the Academy so that a candidate who is rejected for membership in the Academy should have the opportunity to defend himself from any charge against his reputation or qualifications. Dr. J. Mackenzie Brown moved that the communication be filed. The motion was seconded by Dr. Percy Ireland and carried.

VI

Report of the Executive, Research and Finance Committee—Dr. James Milton Robb, Chairman.

1. The Committee recommends that the application fee shall be $25.00, and that the annual dues for Junior Fellows shall continue to be $12.00, and for Senior Fellows, $6.00. The allotment from dues for subscription to the TRANSACTIONS shall remain at $5.00. It was moved and seconded that this recommendation be approved. The motion carried.

2. The Committee recommends that the following resignations be accepted:

Cady, Donald Watson, Pasadena, Calif.
Gulick, John Duncan, Schenectady, N. Y.
Proctor, Donald F., Baltimore, Md.

It also recommends that the following Fellows be transferred to inactive status:

Boyce, William A., Los Angeles, Calif.
Burke, John Robert, St. Petersburg, Fla.
Davis, T. Carroll, Philadelphia, Pa.
Fein, Harry, Boston, Mass.
French, Robert Weller, Malden, Mass.
Ivy, Robert H., Philadelphia, Pa.
Leamer, Bruce V., La Mesa, Calif.
LeCompte, Edward D., Salt Lake City, Utah
Menger, Louis C., Kew Gardens, N. Y.
Munson, Frederick T., Greensboro, N. C.
Quincy, Josiah E., West Roxbury, Mass.
Rimer, Frank H., Pittsburgh, Pa.
Sherman, R. Newton, Bay City, Mich.
Skillern, S. R., Jr., Philadelphia, Pa.
Wafa, Aly Aboul, Port Said, Egypt
Wright, R. Percy, Montreal, Que., Canada

It was moved and seconded that this recommendation be approved. The motion carried.

3. The Committee recommends the following appointments to Standing and Joint Committees:

To the Armed Forces Committee, Dr. M. Elliott Randolph, chairman

To the Committee on Conservation of Hearing, Dr. Dean M. Lierle, chairman

To the Committee on Ophthalmic Pathology, Dr. Michael J. Hogan, chairman

To the Committee on Otolaryngic Pathology, Dr. Paul H. Holinger, chairman.

To the Committee on Pan-American Relations in Otolaryngology, Dr. C. L. Jackson, chairman; Dr. Victor R. Alfaro, Dr. Norton Canfield, Dr. John Marquis Converse, Dr. Paul H. Holinger, Dr. Howard P. House, Dr. LeRoy A. Schall, Dr. Theodore E. Walsh

To the Committee on Prevention of Blindness, Dr. Ralph I. Lloyd, chairman; Dr. Lawrence T. Post, Dr. Alan C. Woods

To the Committee on Scientific Exhibit, Dr. Kenneth L. Roper and Dr. Eugene L. Derlacki, co-chairmen

To the Committee on Standardization of Tonometers, Dr. Peter C. Kronfeld, chairman

To the Committee for the Study of Audio-Visual Instruction, Dr. Dean M. Lierle, chairman; Dr. William L. Benedict, ex officio; Dr. Howard P. House, Dr. Kenneth L. Roper, Dr. A. D. Ruedemann

To the Teachers' Section: Otolaryngology, Dr. Lawrence R. Boies, chairman

To the Teachers' Section: Ophthalmology, Dr. A. D. Ruedemann, chairman

To the American Association for the Advancement of Science, Dr. M. Elliott Randolph, representative

To the American Board of Ophthalmology, Dr. Alson E. Braley

To the American Board of Otolaryngology, Dr. Francis E. LeJeune and Dr. Gordon Harkness

To the American College of Surgeons Board of Governors, Dr. Conrad Berens, representative

To the American Committee on Optics and Visual Physiology, Dr. Frederick C. Cordes, representative

To the American Orthoptic Council, Dr. Frank D. Costenbader, representative

To the Joint Committee on Industrial Ophthalmology, Dr. Edmund B. Spaeth, Dr. John B. Hitz, Col. Victor A. Byrnes

To the National Society for Crippled Children and Adults, Inc., Dr. Dean M. Lierle, representative

Since the Consultative Panel on Tumor Terminology of the American Society of Clinical Pathologists has been dissolved, no appointment of a representative was made.

A motion to accept the recommendation for these appointments was made and carried.

4. The Committee recommends the appointment of Dr. Conrad Berens as chairman of a Committee on Pan-American Relations in Ophthalmology, the other members of the Committee to be named by Dr. Berens. A motion to accept the recommendation was seconded and carried.

5. The Committee recommends the appointment of Dr. Phillips Thygeson as delegate from the United States to serve on the Council of the Fifth Pan-American Congress on Ophthalmology, pending concurrence in this appointment by the American Ophthalmological Society and the Section on Ophthalmology of the American Medical Association. A motion to accept the recommendation was seconded and carried.

6. The Committee recommends that the Secretary write to Dr. Frederick H. Theodore telling him that the Academy is in sympathy with the movement to regulate the preparation of sterile ophthalmic solutions but feels that the matter is already being adequately handled by the committee of the American Medical Association and federal agencies and that no further committee is needed. A motion to approve the recommendation was seconded and carried.

7. The Committee recommends the appointment of Dr. Alan C. Woods to serve on a committee with Dr. David Cogan, representing the Association for Research in Ophthalmology, and others to investigate the various implications of an article in *Science* on "The Nonsurgical Treatment of Cataract" by R. F. Shropshire, Jacob R. Ginsberg and Mendel Jacobi. A motion to approve the recommendation was seconded and carried.

8. The Committee recommends the nomination of Dr. William L. Benedict as Editor-in-Chief of the TRANSACTIONS. A motion to approve the recommendation was seconded and carried.

9. The Committee recommends that the next annual meeting of the Academy be held October 11-16, 1953, at the Palmer House, Chicago. The recommendation was approved.

10. The Committee recommends the following appropriations for the calendar year 1953:

To the Committee on Conservation of Hearing, a sum not to exceed $15,000.

To the Committee on Standardization of Tonometers, $1,000.

To the American Committee on Optics and Visual Physiology, $100 if requested.

To the American Orthoptic Council, $100.

To the Joint Committee on Industrial Ophthalmology, a sum not to exceed $1,000 if matched by an equal sum from the American Medical Association and if the Academy is accorded proper credit for its participation in this Committee.

To the National Research Council, $2,500, if requested.

To the National Society for Medical Research, $1,000 if requested.

The recommendation was approved as read.

VII

Report of the Activities Committee—Dr. Archie D. McCannel, Chairman

Reports of the following committees were reviewed and approved by the Activities Committee:

1. Armed Forces Committee
2. Committee on Conservation of Hearing
3. Committee on Ophthalmic Pathology
4. Committee on Otolaryngic Pathology
5. Committee on Prevention of Blindness
6. Committee on Scientific Exhibit
7. Committee on Standardization of Tonometers
8. Committee on the Study of Audio-Visual Instruction
9. American Association for the Advancement of Science
10. American Board of Ophthalmology
11. American Board of Otolaryngology
12. American College of Surgeons Board of Governors
13. American Committee on Optics and Visual Physiology
14. American Orthoptic Council
15. American Society of Clinical Pathologists Consultative Panel on Tumor Terminology
16. Joint Committee on Industrial Ophthalmology.

Since papers read at the meetings sponsored by the Teachers' Sections of Ophthalmology and Otolaryngology are published in the TRANSACTIONS, reports were not requested. Neither was a report requested from the National Society for Crippled Children and Adults, Inc.

An oral report on the Committee on Pan-American Relations in Otolaryngology was given at the Wednesday meeting of the Council by Dr. C. L. Jackson, chairman of the Committee. A written report was received on November 1 and is included in the published reports in the November-December issue of the TRANSACTIONS.

A motion to accept the report of the Activities Committee as read was seconded and carried.

Dr. Derrick Vail made a motion to the effect that the chairman of a committee should not be permitted to appear before the Council to give his report in person without first submitting a written report. The motion was seconded by Dr. Conrad Berens and carried.

VIII

Report of the Board of Councillors—Dr. Archie D. McCannel, Chairman

1. Nomination of officers:

President: Dr. Frederick C. Cordes, San Francisco, Calif.

President-Elect: Dr. John J. Shea, Memphis, Tenn.

First Vice-President: Dr. Thomas C. Galloway, Evanston, Ill.

Second Vice-President: Dr. Harvey E. Thorpe, Pittsburgh, Pa.

Third Vice-President: Dr. Henry B. Orton, Newark, N. J.

Councillor: Dr. S. Rodman Irvine, Beverly Hills, Calif.

Executive Secretary-Treasurer: Dr. William L. Benedict, Rochester, Minn.

Secretary for Ophthalmology: Dr. Kenneth L. Roper, Chicago, Ill.

Secretary for Otolaryngology: Dr. Howard P. House, Los Angeles, Calif.

Secretary for Instruction in Ophthalmology: Dr. A. D. Ruedemann, Detroit, Mich.

Secretary for Instruction in Otolaryngology and Maxillofacial Surgery: Dr. Dean M. Lierle, Iowa City, Iowa

Secretary for Home Study Courses: Dr. Lawrence R. Boies, Minneapolis, Minn.

Secretary for Public Relations, Dr. Erling Hansen, Minneapolis, Minn.

A motion to accept the nominations of the Board of Councillors as read was seconded by Dr. Derrick Vail and carried.

2. The Board of Councillors recommends that 391 candidates who have fulfilled the requirements for membership be accepted for Fellowship in the Academy.

Dr. Francis LeJeune made a motion that the recommendation of the Board of Councillors be approved. The motion was seconded by Dr. John McGavic and carried.

[*The names of candidates for fellowship approved by the Council are published in the account of the Business Meeting.*]

X

New Business

1. Dr. Franklin M. Foote, Executive Director of the National Society for the Prevention of Blindness, has requested the Academy to appoint a representative to serve on a Committee on Retrolental Fibroplasia. Already on the Committee are Dr. Leonard Christensen of Portland, Oregon, representing the Association for Research in Ophthalmology, and Dr. Algernon B. Reese, representing the A.M.A. Section on Ophthalmology. The Council voted to appoint Dr. William C. Owens of Baltimore, Maryland, as the representative of the Academy on this committee.

2. Dr. Dean M. Lierle proposed the formation of a Committee on Plastic Surgery for the stimulation of interest in this topic in both the Instruction Program and in the Scientific Sessions. He stressed the point that this would not be a society, but would be a committee appointed by the Council with co-chairmen

representing ophthalmology and otolaryngology. One of the functions of this committee would be to arrange programs on plastic surgery for the Academy meetings. Dr. Lierle further recommended the appointment of Dr. Wendell Hughes and Dr. John Marquis Converse as co-chairmen of the Committee.

Dr. Lierle's motion was seconded by Dr. A. D. Ruedemann and carried.

3. Dr. W. L. Benedict reported that he had received a request from Dr. Benjamin Shuster of the American Otorhinologic Society for Plastic Surgery to hold an annual dinner meeting on Tuesday evening during the week of Academy meetings rather than on Thursday, as has been done heretofore. The request was referred to the Program Committee.

4. At the request of Dr. Conrad Berens, the action of the Council in 1951 to discontinue use of lapel buttons for Senior and Life Fellows was brought up for reconsideration. Dr. Francis LeJeune made a motion that the issuance of a lapel button be optional with the member concerned, that the Secretary send it to any person authorized to wear it at that person's request. The motion was seconded and carried.

The meeting adjourned.

ANNUAL BUSINESS MEETING

The business meeting of the Fifty-Seventh Annual Session of the American Academy of Ophthalmology and Otolaryngology convened at 5:30 p.m. in the Crystal Room of the Palmer House, Chicago, October 16, 1952. President James Milton Robb presided.

Report of the Executive Secretary, Dr. William L. Benedict

Fellowship on October 1, 1952:	
Junior Fellows	4,377
Senior Fellows	189
Life Fellows	417
Honorary Fellows	26
Total	5,009
Candidates to be considered at this meeting	391
For elevation to Senior Fellowship on January 1, 1953	94
For elevation to Life Fellowship on January 1, 1953	26
Deaths reported since the last meeting	78
Resignations accepted	3
Reclassified as Inactive Fellows	16

On motion of Dr. Derrick Vail, seconded by Dr. Conrad Berens, the report was accepted as read.

Report of the Treasurer, Dr. Benedict

The Treasurer submitted the audit for 1951 made by Byers, Wobschall and Miller, Certified Public Accountants. This audit appeared in the May-June 1952 issue of the TRANSACTIONS.

The financial status of the Academy as of September 30, 1952, was reported as follows:

Our current assets, including cash on hand, in banks, checks for collection, accounts receivable, and inventories, amount to $44,930.20.

Investments. In the Educational Fund we had $221,507.23; in the Wherry Memorial Lecture Fund, $4,600.00. This, plus advances in the market values of our securities on December 31, 1951, amounts to $227,723.26.

Fixed Assets. Furniture and fixtures, reserve for depreciation, the Embryology of the Eye motion picture film and slides, less reserve for depreciation, amount to $30,080, of which the greater portion consists of the investment in the motion picture film.

Deferred Charges, such as prepaid expenses, prepaid insurance, and postage, with the investment which we now have in the film "Embryology of the Human Ear," which is being produced by Sturgis-Grant, Inc., for the Academy and in which we already have an investment of $21,000.00, amount to $22,000.

Total Assets as of September 30, 1952, are $328,826.27.

Liabilities. Accrued expenses, withholding taxes, deferred dues, and advance payments on bound volumes amount to $3,000.00.

Undisbursed funds from special contributions amount to $5,000; excess of income over expenses for the year to date (October 1) amounts to $22,248.

On motion made by Dr. Conrad Berens, seconded by Dr. Charles A. Perera, the report was accepted as read.

Report of the Senior Member of the Council, Dr. Conrad Berens

Mr. President and Members of the Academy: The Council has received and approved the reports of the Secretary-Treasurer, the Editor of the TRANSACTIONS, the Council Committees, and joint and standing committees These reports will be published in the November-December 1952 issue of the TRANSACTIONS. [See Council Minutes *and* Committee Reports.]

The Council recommends that the application fee for fellowship in the Academy shall remain at $25.00, and that annual dues for Junior Fellows shall be $12.00; for Senior Fellows, $6.00. I move the adoption of this recommendation.

The motion was seconded by Dr. Derrick Vail and carried.

DR. BERENS: The Council recommends the following appropriations for the year 1953:

To the Committee on Conservation of Hearing, a sum not to exceed $15,000.

To the Committee on Standardization of Tonometers, $1,000.

To the American Committee on Optics and Visual Physiology, $100 if requested.

To the American Orthoptic Council, $100.

To the Joint Committee on Industrial Ophthalmology, a sum not to exceed $1,000 if matched by an equal amount from the American Medical Association.

To the National Research Council, $2,500 if requested.

To the National Society for Medical Research, $1,000 if requested. I move the adoption of these recommendations.

Dr. Frederick C. Cordes seconded the motion, which carried.

DR. BERENS: The Council recommends the following appointments to standing and joint committees for the year 1953:

To the Armed Forces Committee, Dr. M. Elliott Randolph, chairman.

To the Committee on Conservation of Hearing, Dr. Dean M. Lierle, chairman.

To the Committee on Ophthalmic Pathology, Dr. Michael J. Hogan, chairman.

To the Committee on Otolaryngic Pathology, Dr. Paul H. Holinger, chairman.

To the Committee on Pan-American Relations in Otolaryngology, Dr. C. L. Jackson, chairman; Dr. Victor R. Alfaro, Dr. John Marquis Converse, Dr. Norton Canfield, Dr. Paul H. Holinger, Dr. Howard P. House, Dr. LeRoy A. Schall, and Dr. Theodore E. Walsh.

To the Committee on Prevention of Blindness, Dr. Ralph I. Lloyd, chairman; Dr. Lawrence T. Post, Dr. Alan C. Woods.

To the Committee on Scientific Exhibit, Dr. Kenneth L. Roper and Dr. Eugene L. Derlacki, co-chairmen.

To the Committee on Standardization of Tonometers, Dr. Peter Kronfeld, chairman.

To the Committee for the Study of Audio-Visual Instruction, Dr. Dean M. Lierle, chairman; Dr. W. L. Benedict, ex officio; Dr. Howard P. House, Dr. Kenneth L. Roper, Dr. A. D. Ruedemann.

To the Teachers' Section: Otolaryngology, Dr. Lawrence R. Boies, chairman.

To the Teachers' Section: Ophthalmology, Dr. A. D. Ruedemann, chairman.

To the American Association for the Advancement of Science, Dr. M. Elliott Randolph, representative.

To the American Board of Ophthalmology, Dr. Alson E. Braley.

To the American Board of Otolaryngology, Dr. Francis E. LeJeune and Dr. Gordon Harkness.

To the American College of Surgeons Board of Governors, Dr. Conrad Berens, reappointed.

To the American Committee on Optics and Visual Physiology, Dr. Frederick C. Cordes, reappointed.

To the American Orthoptic Council, Dr. Frank D. Costenbader, reappointed.

To the Joint Committee on Industrial Ophthalmology, Dr. Edmund B. Spaeth, Dr. John B. Hitz, Colonel Victor A. Byrnes, reappointed.

To the National Society for Crippled Children and Adults, Inc., Dr. Dean M. Lierle.

Since the American Society of Clinical Pathologists' Consultative Panel on Tumor Terminology has been dissolved, no appointment was recommended.

I move the acceptance of these recommendations.

The motion was seconded by Dr. Perera and carried.

DR. BERENS: The Council recommends the appointment of a Committee on Plastic Surgery for the stimulation of interest in this field both in the Instruction Courses and in the Scientific Sessions of the Academy. It is further recommended that Dr. Wendell Hughes and Dr. John Marquis Converse be appointed as co-chairmen of this Committee. I move the acceptance of these recommendations.

Dr. John J. Shea seconded the motion, which carried.

DR. BERENS: At the request of the National Society for the Prevention of Blindness, the Council recommends the appointment of

Dr. William C. Owens to a joint committee on Retrolental Fibroplasia. I move the acceptance of this recommendation.

The motion was seconded by Dr. Vail and carried.

DR. BERENS: At the request of Dr. Thomas D. Allen, Secretary-General for North America of the Pan-American Association of Ophthalmology, the Council recommends the appointment of Dr. Phillips Thygeson as a delegate to the Council of the Pan-American Association of Ophthalmology, which will meet in Santiago, Chile, in January or February of 1956. I move the adoption of this recommendation.

The motion was seconded by Dr. Vail and carried.

DR. BERENS: The Council recommends the formation of a Committee on Pan-American Relations in Ophthalmology. It further recommends that Dr. Conrad Berens be appointed chairman of the committee.

Dr. Algernon B. Reese made a motion to accept the recommendation. The motion was seconded by Dr. Perera and carried.

DR. BERENS: At the request of the trustees of the Association for Research in Ophthalmology, the Council recommends the appointment of Dr. Alan Woods as the Academy representative on a joint committee to investigate the various implications of a recent article in Science magazine regarding a medical treatment for cataract. I move the adoption of this recommendation.

Dr. Vail seconded the motion, which carried.

DR. BERENS: The Council recommends the appointment of Dr. William L. Benedict as Editor-in-Chief of the TRANSACTIONS. I move the adoption of this recommendation.

The motion was seconded by Dr. Carroll R. Mullen and carried.

DR. BERENS: The Council nominates for active fellowship the 391 candidates whose names appear on the sheet handed you as you entered the room. I move that we accept the nominations of the Council.

The motion was seconded by Dr. Mullen and carried.

Newly Elected Fellows of the Academy

Abbey, Joseph Ascher, 429 Palmero St., Corpus Christi, Texas, ALR

Abraham, Raymond Arthur (Capt.), Eye Clinic, U. S. Army Hospital, Camp Roberts, Calif., OP

Adelman, Nathan, 123 E. 83rd St., New York 28, N. Y., ALR

Ajello, Dominick Arnold, 1 Nevins St., Brooklyn 17, N. Y., OP

Alexander, Robert L., Cleveland Clinic Foundation, Cleveland, Ohio, OP

Allen, Wallace Edgar (Comdr.), U. S. Naval Hospital, Oakland 14, Calif., ALR

Alter, Albert Jerviss, Medical Center Bldg., 424 W. Woodruff Ave., Toledo 2, Ohio, OP

Anderson, William Clayton, Jr., 212 W. Boscawen St., Winchester, Va., OP

Applewhite, Norman Elliot, 428 First Nat'l Bank Bldg., Reno, Nev., ALR

Arnold, Ira Lee, Jr., 535 McCallie Ave., Chattanooga 2, Tenn., OP

Attridge, Frank Roy, 2525 Pine St., Vancouver 9, B. C., Canada, ALR

Ayash, John Joseph, 119A Main St. South, Minot, N. D., ALR

Babacz, Teofil, 450 Gay St., Phoenixville, Pa., OP

Bagby, Richard A., 509 Bay St., Tampa, Fla., ALR

Bain, James Britton, 1712 Rhode Island Ave. N.W., Washington 6, D. C., OP

Barrett, Sterling Archie, 721 Black Bldg., Waterloo, Iowa, ALR

Bartley, Max Donald, 803 Hume Mansur Bldg., Indianapolis 4, Ind., OP

Baruch, Richard, 22 Hamilton Ave., Yonkers 5, N. Y., OP

Battles, Morris Lyle, 370 E. Town St., Columbus 15, Ohio, OP

Baum, Gilbert, 235 Columbus Ave., Port Chester, N. Y., OP

Bedrossian, E. Howard, 2027 Spruce St., Philadelphia, Pa., OP

Bell, Bernard Thomas, 148 First St. North, St. Petersburg 1, Fla., OP

Bell, Houston Lesher, 711 S. Jefferson St., Roanoke, Va., ALR

Bell, Richard Parker, Jr., 11621 Detroit Ave., Cleveland 2, Ohio, OP

Benedict, Walter Hanford, Shelbourne Towers, Knoxville, Tenn., OP

Berger, John Van Eman, Jr., 224 W. Washington Ave., Madison 3, Wis., OP

Bernfeld, Michael, 123 S. Stone Ave., Tucson, Ariz., OP

Billet, Edwin, 2625 Grand Concourse, Bronx 68, N. Y., OP

Binder, Donald Keever, 708 Union St., Schenectady 5, N. Y., OP

Birenboim, Irvin Myron, 530 Professional Bldg., 1103 Grand Ave., Kansas City 6, Mo., ALR

Blair, Frank Wilkinson, 642 Rector St., Roxborough Sta., Philadelphia 28, Pa., OP

Boggess, Julian Eugene, 911 College St., Columbus, Miss., ALR
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Boyd, James Leslie, 100 W. 59th St., New York 19, N. Y., OP
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Breakstone, Edgar O., 11200 S. Michigan Ave., Chicago 28, Ill., ALR
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Bricca, Constantine R., Jr., 909 Hyde St., San Francisco 9, Calif., OP
Brickley, Paul M., Mayo Clinic, Rochester, Minn., OP
Brown, Russell Nutt, 870 Fidelity Medical Bldg., Dayton 2, Ohio, OP
Bruce, Robert Addison, 60 Wyoming St., Dayton 9, Ohio, OP
Bryce, Douglas P., 222 Medical Arts Bldg., Toronto, Ont., Canada, ALR
Buck, Leonard S., 130 N. La Cienega Blvd., Los Angeles 48, Calif., ALR
Bunting, Williston Penfield, 1622 Professional Bldg., Kansas City 6, Mo., ALR
Burch, George William, 557 Fair Foundation Bldg., Tyler, Texas, OP
Buxton, Jorge Norman, 17 E. 72nd St., New York 21, N. Y., OP

Caldwell, Pearson Cash, 506 Goodhue Bldg., Beaumont, Texas, OP
Cales, Kenneth Jackson, 233 A St., San Diego 1, Calif., ALR
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Cholst, Mortimer R., 1 Nevins St., Brooklyn 17, N. Y., OP
Clark, Graham, 635 W. 165th St., New York 32, N. Y., OP
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Cobots, Joseph Charles, 423 E. Ninth St., Chester, Pa., OP
Cogswell, Thomas G., 46 Pleasant St., Concord, N. H., OP
Collins, Raymond C., 38 Washington St., East Orange, N. J., OP
Costner, Alfred Nixon, Duke Hospital, Durham, N. C., OP
Cronin, John J., Jr., 414 S. Oak Park Ave., Oak Park, Ill., ALR
Cronin, Thomas P., 101 Bay State Rd., Boston 15, Mass., OP
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Goodwin, Olin Mansell, address unknown, ALR
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Woolmington, Merrill H., Colonial Bldg., Wayne, Pa., OP
Worcester, John Thompson, 220 Engle St., Englewood, N. J., OP

Zeldin, Abraham Joel, 56 Ontario St., St. Catharines, Ont., Canada, ALR

DR. BERENS: The Council recommends the election of the following officers for the year 1953:

President: Dr. Frederick C. Cordes
President-Elect: Dr. John J. Shea
First Vice-President: Dr. Thomas C. Galloway
Second Vice-President: Dr. Harvey E. Thorpe
Third Vice-President: Dr. Henry B. Orton
Councillor: Dr. S. Rodman Irvine
Executive Secretary-Treasurer: Dr. William L. Benedict
Secretary for Ophthalmology: Dr. Kenneth L. Roper
Secretary for Otolaryngology: Dr. Howard P. House
Secretary for Instruction in Ophthalmology: Dr. A. D. Ruedemann
Secretary for Instruction in Otolaryngology and Maxillofacial Surgery: Dr. Dean M. Lierle
Secretary for Home Study Courses: Dr. Lawrence R. Boies
Secretary for Public Relations: Dr. Erling Hansen

I move the election of the officers as read here and as recommended by the Council.

The motion was seconded by Dr. Vail and carried.

DR. BERENS: The Council recommends that the next scientific session of the Academy be held at the Palmer House, Chicago, October 11 to 16, 1953. I move the adoption of this recommendation.

The motion was seconded by Dr. Mullen and carried.

DR. BERENS: Two revisions of the Constitution were presented to the Business Meeting last year and their adoption was approved. These proposed revisions were published in the November-December 1951 issue of the TRANSACTIONS, which was sent to all Fellows, and I now present them for final vote.

Revision I

Article III, now headed "Fellowship," should be entitled "Members and Fellows."

Revision II

The first paragraph of Article III, Section (a), under "Active Fellowship," now reads as follows:

"A candidate for Active Fellowship shall be a member in good standing of his or her local, county, state and/or national medical society and must be certificated and approved by the American Board of Ophthalmology, the American Board of Otolaryngology or the American Board of Plastic Surgery. When a candidate is elected to Fellowship in the Academy, he shall be classified in the Directory of the Academy as practicing the specialty or

specialties for which he holds a Board certificate."

It has been recommended that this be changed to read:

"A candidate for Active Fellowship shall be a member in good standing of his or her local and national medical society and shall be certificated and approved by a national examining and certifying specialty Board acceptable to the Council."

I move that these changes in the Constitution be adopted.

The motion was seconded by Dr. Vail and carried.

DR. BERENS: Mr. President, I wish to recommend the acceptance of this entire report.

Dr. Mullen seconded the motion to accept the report as read. The motion carried.

PRESIDENT ROBB: Is there any new business to come before the annual meeting? If not, Dr. Cordes, I should like to have you come to the platform. Ladies and gentlemen, the new President of the American Academy of Ophthalmology and Otolaryngology.

DR. CORDES: President Robb and Fellow Members: I want again to express my great appreciation of the honor that you have conferred upon me. . . . I realize the responsibilities that go with the honor, and I am going to do everything I can to maintain the high level the office has heretofore enjoyed, and I hope I will also enjoy the splendid cooperation you have given President Robb.

DR. ROBB: Thank you very much, Dr. Cordes. Now, Dr. Shea of Memphis, our President-Elect.

Dr. John J. Shea acknowledged the applause of the members.

DR. ROBB: I will not make a speech for Dr. Shea. I am sure he will make a fine President and will further the development of the Academy.

The meeting adjourned at 6:00 p.m.

COMMITTEE REPORTS

Upon recommendation by the Activities Committee, the Council voted acceptance of the following reports of standing and joint committees.

REPORT OF THE ARMED FORCES COMMITTEE

M. Elliott Randolph, M.D., Chairman

During the current year, members of the Armed Forces Committee have periodically contacted representatives of the Army, Navy and Air Force in Washington and elsewhere. The Committee has been informed that the respective branches of the Armed Forces have a sufficient number of qualified eye and ear, nose and throat specialists at the present time and there were no problems concerning which the Committee could be of any assistance at the present time.

During the spring of 1952, each member of the Committee was asked for an opinion as to the advisability of continuing this Committee. It was the unanimous opinion that the Academy discontinue the Armed Forces Committee for the present, particularly as the Academy is now so ably represented on the Armed Forces Medical Policy Council by Derrick Vail, M.D., and Dean M. Lierle, M.D.

The individual members of our armed forces in Washington have always been most cordial and cooperative. However, it seems quite obvious to the Committee that the Academy can be of no particular service at this time. The Committee has been asked to do a few trivial favors, slightly out of the Academy's domain but other than this, it is not felt that this Committee is really needed. If a more grave emergency arises, the Committee can be reappointed.

REPORT OF THE COMMITTEE ON THE CONSERVATION OF HEARING

Dean M. Lierle, M.D., Chairman

Two meetings of the Committee on the Conservation of Hearing of the American Academy of Ophthalmology and Otolaryngology were held in Chicago during the past year—one at the time of the Academy convention, October, 1951, and the other on April 5 and 6, 1952.

I. The following standing subcommittees were established: (1) Finance, (2) Hearing Testing and Hearing Aids, (3) Noise in Industry, (4) Otosclerosis, (5) Public Relations, (6) Research and (7) School Programs.

II. Dr. Norton Canfield was authorized to use the remaining funds from the Economic Survey to conduct a survey in the State of Connecticut. The project is to make a study which will (1) reveal the extent and nature of the problems created by the loss or impairment of hearing with special attention to the resulting economic cost and social dislocations; (2) ascertain what is being done through existing agencies, medical, educational, social and governmental, toward the relief, prevention and rehabilitation of persons suffering from hearing disorders; (3) determine what needs to be done in the way of education, research and the useful implementation of existing knowledge about relief and rehabilitation of persons with hearing defects; and (4) estimate the potentialities of securing funds to carry out such a problem.

III. During the past year the film "Your Ear and Noise" was shown to the following organizations in the various cities:

Gates Rubber Co., Safety Department, Denver, Colo.
A.M.A. Convention, Los Angeles, Calif.
Groups of physicians and nurses, Cleveland, Ohio.
Allis-Chalmers, Safety Department, La Crosse, Wis.
Industrial Conference, physicians, nurses and safety, Milwaukee, Wis.
Eye, Ear, Nose and Throat Club, St. Louis, Mo.
General Motors, physicians, Detroit, Mich.
General Motors Annual Medical Conference, Cincinnati, Ohio.
Local otologists, Flint, Mich.
Third Annual Michigan Health Day Conference, Flint, Mich.

IV. Drs. Guild, Nash, House, Glorig and Wheeler presented reports at the Conference on "The Acoustic Spectrum" given by the University of Michigan School of Public Health in Ann Arbor, Michigan, February 5 to 8, 1952.

V. On March 3 and 4, 1952, Drs. Guild, Glorig, House and Wheeler gave reports at

the Conference on Industrial Noise held by the Committee on Hearing National Research Council in Washington, D. C.

VI. The following papers have been published:

"Various Aspects of Noise Problems," A.M.A. Archives of Industrial Hygiene and Occupational Medicine, February 1952

"The Acoustic Spectrum," University of Michigan Press

VII. The following manuals have been approved for publication:

1. Guide for Physicians Concerned with Hearing Conservation in Industrial Noise, in press
2. Guide for Conservation of Hearing in Industry, in press
3. Helpful Hints for Handling the Hearing Handicapped, published June 1952
4. Guide for the Diagnosis and Management of Hearing Loss in Preschool Children, published in September-October 1952 issue of TRANSACTIONS, reprints available on request.
5. Manual for the General Practitioner on Rehabilitation of the Hard of Hearing

A revision of the Syllabus of Audiometric Procedures in the Administration of a Program for the Conservation of Hearing of School Children, now known as "A Manual for a School Hearing Conservation Program" was published in May 1952.

VIII. A course designed for the training of industrial audiometric technicians was also prepared.

IX. Dr. Wheeler submitted the following results on his investigations:

A. *Research in Plants*

1. An analysis of audiometric data taken from one company has brought out an interesting fact, namely, that the temporary effects of noise upon hearing acuity, as shown by the temporary threshold shift, seem to be independent of the amount of hearing loss already existing. This fact has the following important connotations: (a) it is additional support for the hypothesis that ears already impaired can be further affected by noise; (b) it suggests that susceptibility testing in its present form can be applied to impaired ears as well as normal ears.

2. An analysis of 824 preplacement audiograms, recently completed, has shown the following facts: (a) 22.5 per cent of the employees hired in the past two years have entered company employment with significant audiometric loss at the time of hiring; (b) 6 per cent of these men had severe audiometric losses; (c) an additional 6 per cent had more loss in one ear than in the other; and (d) the remaining 9.5 per cent had moderate audiometric losses.

3. A glass foundry has recently been added to the list of active plants in research. A study has been completed in one department of these plants with the following results: (a) the noise level was found to average 100 db over-all with an essentially flat spectrum; (b) 21 men were studied (this group had worked in this noise for an average of 17 years); (c) no man among the 21 now has normal hearing acuity.

4. Eight additional plants are now in various stages of preparation for cooperation with the Sub-Committee. These plants are located in the East, Mid-West and West.

B. *Ear Protectors*

1. The efficiency of ear protectors is being studied experimentally in industrial plants. A supply of commercially available protectors has been accumulated. These are being tested with the free field technic in the new facilities. Twelve students and six workmen are now participating in this part of the problem.

X. In order to more effectively continue the work Dr. Wheeler has started, expansion is needed and would require the following:

A. A larger budget.

B. Additional equipment and personnel, including an otologist and technicians.

C. The Council on Physical Medicine of the A.M.A., as well as the manufacturers and insurance companies, are anxious for the committee to study the problem of standardization of ear defenders. Some financial arrangement would be required for this work.

D. Consideration of expanding the research to other areas in addition to the West Coast.

XI. A meeting was held with fourteen representatives of different insurance companies preceding the meeting in April and the problem of a larger budget was presented for consideration.

XII. Suggested new projects:

A. "Open Letter to Parents of Preschool Deaf Child"

B. "Manual on Detection of Malingering"

C. Dr. Glorig to investigate the possibilities of instigating a survey of schools for deaf regarding medical services, testing facilities, criteria for admission and methods of training.

XIII. Dr. Carl McCaskey and Dr. Dean M. Lierle were appointed as a Liaison Committee with the American Medical Association.

XIV. A scientific program for the annual Academy meeting was scheduled for Sunday, October 12, 1952. [Papers read at this meeting will be published in one of the forthcoming issues of the TRANSACTIONS.]

XV. The Committee on the Conservation of Hearing respectfully recommends that the American Academy of Ophthalmology and Otolaryngology contribute financial support to the extent of granting $15,000 next year in order that Dr. Wheeler may continue the research on industrial noise. This would include $7,000 for Dr. Wheeler's salary, $500.00 for travel, and $2,500 for secretarial and miscellaneous expense. In addition $5,000 will be needed for general expense of other activities of the Committee on the Conservation of Hearing.

REPORT OF THE COMMITTEE ON OPHTHALMIC PATHOLOGY

MICHAEL J. HOGAN, M.D., Chairman

Informal committee meetings were held during April 1952 and June 1952. As a result, a number of items have been considered to be pertinent to the function of this committee.

The following subjects were discussed:

1. The teaching of pathology during the Instruction Course periods
2. The teaching of pathology during the General Session periods
3. Preparation of teaching manuals on special pathologic diseases
4. A survey of private eye pathology laboratories to determine their capacity to process eyes and biopsies
5. Loan sets for students

Several of the above subjects can be presented at an informal discussion with the Chairman on Instruction Courses and Chairman of the Scientific Sessions.

Seven teaching manuals on special ophthalmic pathology have been projected. These manuals are intended to complement the new Textbook and Atlas on Ophthalmic Pathology. The titles are as follows:

1. Histology; methods of examination of eyes and review of gross pathology
2. Cytology and inflammation
3. Tumors
4. Pathology of uveitis
5. Pathology of glaucoma
6. Pathology of ocular injuries and postoperative eyes
7. Pathology of optic nerve diseases

The committee would appreciate comment as to the advisability of this program.

A survey of existing private eye pathology laboratories has been made during the year. This survey was initiated following the April meeting at the Armed Forces Institute of Pathology. According to information presented, the Armed Forces Institute is acquiring eyes at the rate of 2,500 per year from the Armed Forces, Veterans Administration Hospitals and private sources. Definitive reports on these specimens are made 12 to 18 months after acquisition. The acquisition of specimens from the Armed Forces is increasing yearly and would be sufficient to keep the pathology laboratory busy if private specimens were diverted to independent laboratories. If it were possible for private pathology laboratories to process outside specimens, a more efficient and rapid system of reporting could be devised. After consultation and agreement with General DeCoursey a survey of existing laboratories in the United States was made.

The results of this survey show that laboratory facilities exist in various medical colleges, eye institutions and eye hospitals to process all the available private eye specimens in the United States. It is suggested the Council consider sponsoring publicity to urge ophthalmologists to send eye specimens to private laboratories. Lists of laboratories in all portions of the United States willing to process eyes could be published along with the announcement and similar announcements could be republished in the principal eye journals. General DeCoursey has assured us that he would be glad to refuse acquisition of private specimens provided outside laboratories could process them.

It has been agreed that eye pathologists would refer unusual and outstanding material acquired to the registry of ophthalmic pathology.

Some eye pathologists feel a charge should be made by pathologic laboratories to cover expenses and help maintain their laboratories. In our questionnaire most pathologists were agreeable to a $10 to $15 charge for this service. We therefore feel that the Academy should subscribe to a charge for specimens submitted to private eye pathology laboratories.

The development of loan set facilities would result from the increased number of specimens received by individual laboratories. A partial survey shows that sufficient sets are available except during emergency periods, such as the two months prior to Board examinations. Most laboratories have small sets which are available for these emergencies and if candidates were informed, they would know where to write for them. The Home Study Courses could make a survey to see if sufficient sets are available and publish the results in the TRANSACTIONS.

We would like to recommend the appointment of Dr. Phinizy Calhoun, Jr., of Atlanta, Georgia, as a member of this committee.

REPORT OF THE COMMITTEE ON OTOLARYNGIC PATHOLOGY

PAUL H. HOLINGER, M.D., Chairman

This Committee was appointed by the Council of the Academy in October 1951. A very complete, informative and helpful letter was received December 1, 1951, from Dr. William L. Benedict who reviewed the actions and contributions of previous Committees, the evolution of the Registry, and the development of the Atlases. This material was studied by the members of the Committee in an effort to determine our own position in regard to these activities and to determine the purposes, duties and plan of action of the present Committee.

Three meetings of the members of the Committee were held during the year and additional activities carried out individually and through correspondence. We should like to add the following members of the Academy to the Committee: Dr. David D. DeWeese, Portland, Ore.; Dr. Lewis F. Morrison, San Francisco, Calif.; Dr. John A. Murtagh, Hanover, N. H.; and Dr. James McLaurin, Baton Rouge, La.

It would appear that the most important function of the Committee at this time is to obtain the assistance of the members of the American Academy in rebuilding the Registry of Otolaryngologic Pathology. The Committee members made an effort to do this, but otolaryngologists are reluctant to submit material until they have definite assurance that this material will not be transferred to other divisions, and thus only indirectly accessible to Otolaryngology; and that some effort will be made to return material to the Otolaryngologic Registry which was submitted by otolaryngologists but has since been transferred elsewhere.

The Committee is desirous of establishing a closer relationship between the Registry and the members of the Academy through the establishment of a fellowship in Otolaryngologic Pathology at the Army Medical Museum similar to the fellowship now in existence in Ophthalmology. The very recent appointment of Dr. Muriel Raum as Acting Chief, Otolaryngologic Pathology Section, Pathology Branch, Pathology Division, establishes this relationship in a most excellent manner. It is obvious that this appointment will greatly facilitate the accomplishments of the purposes of the Committee. Since Dr. Raum will be in Chicago during the October 1952 meeting of the Academy, a meeting of the Committee with Dr. Raum will be held to organize a definite program to interest otolaryngologists and otolaryngological teaching centers in submitting material to the Registry and to again point out to the Academy membership the manner in which material may be submitted, the type of material of interest to the Registry, the exact details of forwarding it to the Registry and the information which is to accompany the material. While this information is well known to some, it is obvious that many members, especially the new members of the Academy are not familiar with it and with the importance of this activity.

REPORT OF THE COMMITTEE ON PAN-AMERICAN RELATIONS IN OTOLARYNGOLOGY

CHEVALIER L. JACKSON, M.D., Chairman

Third Pan-American Congress of Otorhinolaryngology and Bronchoesophagology

The Third Pan-American Congress of Otorhinolaryngology and Bronchoesophagology was held in Havana, Cuba, January 20 to 24, 1952. Eighty-nine otolaryngologists attended from the United States, and Dr. James M. Robb was Vice-President for the United States and head of the American delegation. Dr.

Chevalier L. Jackson was Delegate and Dr. Victor Alfaro was Alternate, representing the Academy on the Directive Council of the Pan-American Association during the Havana meetings.

Scientific Sessions and social functions were well organized by the Cuban Committee, headed by Dr. Jose Gros, President, and Dr. Pedro Hernandez Gonzalo, General Secretary. Other members of the Cuban Committee were Dr. Reinaldo de Villiers, Dr. Roberto Machado, Dr. Jose Xirau, Dr. Alfredo Petit, Dr. Abelardo Codinach and Dr. Fernando Santamarina. The Directive Council of the Pan-American Association held its first meeting, with representatives from the majority of American nations present, and at the conclusion of the Congress the General Assembly met in executive session to consider slight modifications in the Constitution and to elect the first officers of the Association. The officers elected were as follows: Dr. Justo M. Alonso, Uruguay, President; Dr. Juan Manuel Tato, Argentina and Dr. Aloysio Novis, Brazil, Vice-Presidents; Dr. Chevalier L. Jackson, United States, Secretary; Dr. Plinio de Mattos Barretto, Brazil, and Dr. Pedro Hernandez Gonzalo, Cuba, Assistant Secretaries; Dr. Paul H. Holinger, United States, Treasurer.

Fourth Pan-American Congress in Mexico City

At the executive session, Mexico City was designated the site of the next Congress and Dr. Ricardo Tapia Acuna named President thereof. The Mexican Committee has been very well organized in the months since the Havana meeting, with Dr. Tapia as Chairman and Dr. Bustamante Gurria in charge of program. Other members of the Mexican Committee are Dr. Maximo Garcia Castaneda, Dr. Juan Berreucos, Dr. Juan Andrade Pradillo, Dr. Manuel Lopez y Lopez, Dr. Ramon del Villar, and Dr. Luis Vaquero.

At a luncheon meeting on October 14 the members of the Academy Committee on Pan-American Relations in Otolaryngology met with members of the Mexican Committee and Officers of the Pan-American Association of Ophthalmology to discuss various matters of mutual interest, and particularly the date for the Mexican Congress. The last week of February 1954 was decided upon.

Directory

The first two editions of the Directory of Otorhinolaryngology in the Americas were financed by the Academy and there is now definite need for a third edition. Mr. Saavedra of the Maico Company has volunteered to act as chairman of a committee of sponsoring advertisers to help obtain sufficient advertising to finance this third edition. At the luncheon meeting of the Committee the possible simultaneous publication of a Directory of Ophthalmologists in the Americas was suggested and Dr. Tomas Yanes of Havana was mentioned as a possible editor. Undoubtedly Dr. Moacyr Alvaro would also cooperate. Dr. Fowler suggested that the Directory would be of greater value if more information were included concerning the qualifications of the individual specialists listed.

Kellogg Fellowships

The Kellogg Foundation reported to us last year that it had granted twenty-nine fellowships in Otolaryngology, spending almost $90,000. No additional fellowships were granted during the past year, though the Foundation is willing to grant some additional fellowships until each faculty of medicine in the fifty-odd Latin American medical schools has "at least one well trained young otolaryngologist among its members." Dr. Kinde, Director of the Division of Medicine and Public Health of the Foundation, will be in Philadelphia on Friday, November 14, 1952, and has promised me an interview concerning the future of this Fellowship Program and ways in which the Academy and the Pan-American Association can cooperate.

Coordination of Pan-American Relations in Otolaryngology with Pan-American Relations in Ophthalmology

Another matter discussed at the above-mentioned luncheon meeting was correlation of activities between the ophthalmologists and the otolaryngologists interested in Pan-American affairs during the Academy meetings. It would seem very desirable for a joint committee to arrange each year some function such as a dinner meeting where both groups could meet with their colleagues from the Latin American countries. This need not lead to any combination of the congresses, but since the Academy is already a joint organization, both the otolaryngologists and the ophthalmologists will be in Chicago at the same time and could with benefit meet jointly.

I had intended to suggest that if the Academy wished to continue a Committee on Pan-American Relations in Otolaryngology, Dr. Robb and Dr. Schall would be appropriate additions. Other members particularly interested are Drs. Shambaugh, Lindsay, Lederer and Hansel. Probably C. L. Jackson, Victor Alfaro and Paul Holinger should remain on the

Committee because of the fact that they are officers of the Pan-American Association. However, since there is apparently no Academy Committee on Pan-American Relations in Ophthalmology, and in view of the fact that some joint work seems desirable, it might be better for the Academy to have a joint Committee on Pan-American Relations representing both the ophthalmologists and the otolaryngologists, and this is hereby formally suggested.

Membership

The Pan-American Association of Otolaryngology is planning an active campaign to increase membership before the Mexican Congress. There are only 190 United States members now, but a circular letter is going to be sent out to all otolaryngologist members of the Academy with an application blank, and a notice will also be inserted in the Academy TRANSACTIONS.

REPORT OF THE COMMITTEE ON PREVENTION OF BLINDNESS

RALPH I. LLOYD, M.D., Chairman

The liaison committee has little to report this session. There was a meeting of the eye men with Dr. Foote, Director of the National Society for the Prevention of Blindness, at which Dr. Lawrence T. Post represented our committee. The only matter of importance was the question of using penicillin in place of the time-tested silver nitrate in the eyes of the newborn. As before, the almost unanimous opinion was for continuing the use of silver nitrate on the grounds of efficiency and simplicity in application.

REPORT OF THE COMMITTEE ON SCIENTIFIC EXHIBIT

KENNETH L. ROPER, M.D., Chairman

Acting upon the recommendation made by the Council of the Academy that an otolaryngologist be appointed to serve on the Committee on Scientific Exhibit, Dr. Eugene L. Derlacki, Chicago, was appointed to serve on the Committee and has been most helpful and cooperative in the job we have had to do. Both Dr. Derlacki and I attended the meeting of the Program Committee which met in Chicago last January.

Following a request for additional commercial exhibit space in the Red Lacquer Room, a new diagram layout of the Red Lacquer Room was made giving 18 commercial exhibit spaces, an addition of 6 over previous years. At the same time plans were made to utilize wall space areas of the Red Lacquer Room heretofore not used for exhibits, since their location permitted no more than two or four feet of side walls.

Some "General Instructions for Exhibitors" were also prepared to be printed on the back of the Scientific Exhibit Layout diagram, which has almost eliminated the innumerable inquiries received in former years from exhibitors after notification of acceptance of their exhibits.

A new Application for Space form was prepared upon which essential information can be clearly set forth, from which information for publication purposes as well as the construction of the exhibitors' individual booths by the engineers at the Palmer House can be accurately and quickly obtained. The Application for Space form was made up in duplicate so that each applicant can retain a copy of his application. On the back of the applicant's duplicate copy of the Application form, detailed information has been included, which again has eliminated many unnecessary queries from prospective exhibitors.

On March 1, the Committee met for the purpose of allotting space for the 1952 Academy meeting. At that time there were a far greater number of applications on hand than we could find space for. Twenty-nine exhibits were accepted for this year's Scientific Exhibit, 17 of which were ENT exhibits, 11 EYE and 1 mixed. At the time of this writing, the Committee has on hand 18 applications for scientific exhibit space for 1953.

All exhibitors were notified of the acceptance of their exhibits under date of May 1. Each exhibitor's space was clearly identified for his advance information on the Scientific Exhibit Layout diagram, on the back of which the "General Instructions for Exhibitors" was printed.

REPORT OF COMMITTEE ON STANDARDIZATION OF TONOMETERS

JONAS S. FRIEDENWALD, M.D., Chairman

Testing Stations

The work of the Testing Stations has continued along previously established lines. A

TABLE I

TONOMETERS SUBMITTED TO TESTING STATIONS

July 1, 1951 — June 30, 1952

TESTING STATION	NO. RECEIVED	SATISFACTORY	STANDARDIZED	REPAIRED AND STANDARDIZED	REJECTED
Dr. Alvaro Sao Paulo	14	0	10	1	3
Dr. Harrington San Francisco	48	13	12	9	14
Dr. Kronfeld Chicago	245	65	156	16	8
Dr. Posner New York	53	10	23	15	5

TABLE II

ELECTRICAL TESTING LABORATORIES, INC.

July 1, 1951 — June 30, 1952

NUMBER TESTED	NUMBER CERTIFIED ON INITIAL TEST	TOTAL NUMBER CERTIFIED
850	746	796

detailed statistical report will be found in Table I.

Certification of Tonometers

Certification of tonometers by the Electrical Testing Laboratories, Inc., has been continued (Table II). The manufacturer of the McLean tonometer (E. B. Meyrowitz Surgical Instruments Co., Inc.) has requested that arrangements be made for the certification of his product, and negotiations are being conducted with the manufacturer leading towards the establishment of standards and tolerances for this instrument.

A statistical analysis is being performed on the measurements made by the Electrical Testing Laboratories, Inc., on some three thousand Schiøtz tonometers that have so far been certified. This study was undertaken in order that more precise information should be available as to range of variations among certified tonometers.

Decennial Report

At the last meeting of the Committee on Standardization of Tonometers, it was decided to publish a decennial report of the work done by this Committee. This report is to include (a) studies on the calibration of tonometers by Dr. Friedenwald, (b) statistical analysis of certified tonometers referred to above, (c) detailed report on the methods of measurement used in the testing and certifying procedures by Dr. Kronfeld. The work on the preparation of the decennial report is in progress.

Foreign Tonometers

An analysis of variations found in recently imported foreign tonometers by Dr. Kronfeld has been submitted to the Academy for publication.

EXPENDITURES

July 1, 1951 — June 30, 1952

Testing Stations:	
Chicago Testing Station	$ 802.18
San Francisco Testing Station	148.00
New York Testing Station	100.77
Part-time Secretary and Technician	210.00
Statistical Study	500.00
Printing, Postage, Miscellaneous	165.57
	$1,926.52

REPORT OF THE COMMITTEE FOR THE STUDY OF AUDIO-VISUAL INSTRUCTION

DEAN M. LIERLE, M.D., Chairman

The Committee has promoted the production of a motion picture on "The Embryology of the Human Ear" with the cooperation of the

Carnegie Institute of Washington Department of Embryology, Baltimore, Maryland, and under the direction of Dr. Franz Altmann. As general consultants in the preparation of the script and storyboard, the following Fellows have generously given their time and assistance to the Committee: Dr. Philip E. Meltzer, Dr. Edmund P. Fowler, Jr., Dr. Lawrence R. Boies.

Two meetings have been held with the producer, Sturgis-Grant, Inc., the last on September 26, 1952. Progress was reported on the preparation of the outline of the picture and the plans of operation. Completion of the picture is predicted for July 1953.

The Committee, in cooperation with the Medical Audio-Visual Institute (formerly Medical Film Institute) of the Association of American Medical Colleges, sent a questionnaire to all Fellows requesting information regarding all motion pictures produced by Fellows pertaining to the eye, ear, nose and throat. The response was encouraging but not completely satisfactory, and other forms are being distributed. The Committee does not intend to build a film library nor to set up a booking agency for the loan of films. Full information on all films of use in teaching is requested for use by the Medical Audio-Visual Institute for reviews, and for classification in the Library of Congress.

The motion picture on "The Embryology of the Eye," produced by the Academy in 1950, has been well received and is used in conjunction with the lantern slides prepared for teaching embryology in a number of medical schools.

We recommend that the committee be continued.

REPORT OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

M. Elliott Randolph, M.D.
Academy Representative

In my capacity as representative of the Academy to the American Association for the Advancement of Science, this is to notify you that I have nothing to report on the activities of this organization insofar as concerns the American Academy of Ophthalmology and Otolaryngology.

REPORT OF THE AMERICAN BOARD OF OPHTHALMOLOGY

Robert J. Masters, M.D.
Academy Representative

The Board has conducted 103 examinations and issued 3,597 certificates.

At our last written qualifying test, held on February 4 and 5, 1952, 301 candidates presented themselves for examination: 158 candidates passed; 106 were conditioned; 37 failed.

Practical examinations were held at Chicago in October 1951 and Philadelphia on May 29 to June 3, 1952. At the Chicago practical examination, 103 candidates passed; 30 were conditioned; 11 failed. At the Philadelphia practical examination 152 candidates passed; 19 were conditioned; 3 failed.

Future practical examinations are scheduled for Chicago on October 6 to 10, 1952; at New York City on June 6 to 10, 1953.

Fifty-five ophthalmologists have served on the Board since its organization in 1916. The 1952 personnel of the Board is as follows:

Term Ends	Section, AMA	A. O. S.	Academy
December 31, 1952	Payne	Atkinson	Masters
December 31, 1953	Dunnington	Adler	Vail
December 31, 1954	Allen, J. H.	Dunphy	Fralick
December 31, 1955	Thygeson-Hogan	Chandler	Bruce

The officers of the Board for 1952 are John H. Dunnington, New York City, Chairman; Derrick Vail, Chicago, Vice-Chairman; Edwin B. Dunphy, Boston, Secretary-Treasurer.

Brittain Payne of New York City and Walter Atkinson of Watertown, N. Y. have been re-appointed for second four-year terms on the Board by the Eye Section of the A.M.A. and American Ophthalmological Society, respectively. Phillips Thygeson of San Jose, California, resigned from the Board at the Philadelphia meeting in June. Dr. Thygeson was the representative of the Eye Section of the A.M.A., and Michael Hogan of San Francisco was appointed by the Section to serve out the remainder of Dr. Thygeson's term, which ends on December 31, 1955.

A new directory of Board diplomates will be available in January 1953, its selling price having been set at $2.00.

The American Board of Ophthalmology presented an exhibit at the Pan-American Congress in Mexico City last January. The exhibit apparently was much appreciated by our Pan-American friends, whose comments were very gratifying.

REPORT OF THE AMERICAN BOARD OF OTOLARYNGOLOGY

C. H. McCaskey
Francis E. LeJeune
Academy Representatives

We wish to report that the American Board of Otolaryngology certified 79 candidates, conditioned 16 and failed 3 at the examination given by the Board in Toronto, May 12-16, 1952.

At the recent meeting of the Board held in Chicago, October 6-10, 1952, the Board certified 77 candidates, conditioned 17 and failed 2.

It was recommended at the spring meeting that Dr. Gordon Harkness represent the Academy of Ophthalmology and Otolaryngology; Dr. Philip Meltzer, the American Otological Society; and Dr. L. R. Boies, the Triological Society. Dr. Lewis F. Morrison of San Francisco and Dr. Harry P. Schenck of Philadelphia were appointed directors of the Board.

REPORT OF THE BOARD OF GOVERNORS OF THE AMERICAN COLLEGE OF SURGEONS

Conrad Berens, M.D.
Academy Representative

Your representative attended several meetings of the American College of Surgeons in Atlantic City and New York and the following are some of the matters which were considered.

It was decided that the annual meeting of governors will be held the Sunday before the Clinical Congress and that more time will be given for discussion of important problems. Much thought is being given to a long range program to stop fee splitting.

Resolutions have been prepared disapproving organizations which tend in any way to lower surgical standards.

Methods of selecting and electing Governors are being studied.

Study of amount of surgery done by men who are not eligible for admission to the College indicates that they do 60 per cent of the surgery (Academy of General Practitioners statement) in the United States. The question is whether the College can continue to disregard this group. A committee has been appointed to study the problem of membership for these men, because Ochsner and others are opposed to continuing to overlook this group. Our standards are always being raised and these men are shunted to organizations with lower standards. Attention to Junior candidates helps in mitigating this problem.

Chapter meetings are growing in importance and all fellows are urged to support this important activity. In 1954, the American College of Surgeons will go to Atlantic City and will do away with clinics. Television may even cover the United States of America, using coaxial cables. This meeting is being held as an experiment, because of the growing attendance at meetings and the difficulty of conducting wet clinics.

The College now has a Public Relations Department which should help in educating the public concerning the activities of the College and the protection it offers in regard to the practice of surgery.

It was doubted by Dr. Graham that the International College of Surgeons was undermining the work of the College. The American College of Surgeons drew up a resolution against the International College of Surgeons for developing a special certification board for surgery. The International College of Surgeons offered suit against the American College of Surgeons and individual members. The American College of Surgeons has not retracted the resolution condemning the development of a special board.

The International College of Surgeons has approached the American Medical Association to act as mediator between the American College of Surgeons and the International College of Surgeons. The American Medical Association discussed this even though the present Board of Surgery is under its auspices. Dr. Lull asked for a conference between the trustees of the American Medical Association and the representatives of the American College of Surgeons. This meeting was declined by the American College of Surgeons, as it was considered that the American Medical Association had all the necessary facts. The American Medical Association was then asked to publicize in the Journal of the American Medical Association that it would continue to support specialty boards under its aegis. There is an impasse in these negotiations at present.

Ophthalmologists and otolaryngologists now compose 18 per cent of the College membership and their participation and interest in the meetings is increasing.

General Hawley spoke on the accreditation of hospitals. The new director of the Commission on Accreditation, Dr. Crosby, was formerly superintendent of the Johns Hopkins Hospital. The American College of Surgeons will still keep inspectors in the field, especially

in studying cancer hospitals. The American Medical Association will inspect hospitals accredited for resident training and the American Hospital Association, all other hospitals. General Hawley reports that there is a great enthusiasm for the American College of Surgeons in South America. However, he pointed out that it is difficult to evaluate applicants from these countries. The American College of Surgeons wants only the very best surgeons and surgeon specialists. The Sao Paulo meeting promises to be a great and important meeting.

Concerning group disability insurance, it is requested that if cases are mishandled, the facts should be brought to the attention of the College. It is believed that premiums now paid will soon permit extension of benefits.

The American College of Surgeons is not merely a society but an institution of importance in the over-all medical picture in the United States. We still have much to do to improve surgical practice which might bring discredit to the College, and I am sure that all the members of the Academy and the College will do all in their power to add luster to the surgical specialties and to prevent discredit from affecting the practice of surgery in the United States of America.

REPORT ON THE AMERICAN COMMITTEE ON OPTICS AND VISUAL PHYSIOLOGY

FREDERICK C. CORDES, M.D.
Academy Representative

The American Committee on Optics and Visual Physiology held a meeting on June 5, 1952 at Hot Springs, Virginia. The following committee reports were presented and accepted at that meeting:

It was moved and carried that the American Committee on Optics and Visual Physiology apply to the Snyder Ophthalmic Foundation for a further grant of $1,000 for the myopia project for 1953.

The election of a new chairman and secretary-treasurer was tabled until the fall meeting.

COMMITTEE REPORTS

A. *Committee to Consult with Optometrists* (National Interprofessional Committee on Eye Care)

The following report submitted by Dr. Avery Prangen was accepted with appreciation:

"This committee has held two meetings this past year, one in Chicago on October 14, 1951, and the other in New York City on December 9, 1951. Minutes of these meetings were sent to all members of the American Committee on Optics and Visual Physiology. These minutes fully describe the activities of your subcommittee.

"I would call your attention to 'Some recommendations of this committee to its several parent groups' on page 2 of the December 9, 1951, minutes. I discussed these recommendations with you verbally last October before the minutes were written up. The parent committee agreed with these ideas and asked the subcommittee to continue. In regard to these recommendations, your subcommittee has acted as follows:

"1. Promoted the formation of state interprofessional committees on eye care. Committees have been formed in New Jersey, Minnesota, North Dakota and South Dakota. Negotiations toward the formation of state committees are being carried on in Ohio, New Mexico, Iowa, Montana, Washington, Wisconsin and Illinois. There is a marked interest in the formation of these committees in the various states. Generally speaking optometrists, opticians and the average eye, ear, nose and throat physician have shown the most interest. The least interest or outright opposition comes from the upper level ophthalmologists. Incidentally, the first named groups see the most patients and are most desirous of cooperative endeavor in eye care.

"Your parent committee advised the subcommittee to seek more publicity through ophthalmological journals. I submitted the minutes of the meeting of the subcommittee on December 9, 1951, to Dr. Vail of the American Journal of Ophthalmology and to Dr. Adler of the Archives of Ophthalmology. Dr. Vail replied that he was interested in this material and probably would give the committee publicity in the American Journal of Ophthalmology. Dr. Adler has not replied.

"2. 'Correcting the amendment to the National Social Security Act, known as H. R. 6000, year 1950.' As seen from our minutes, this is a difficult task. I have had word recently that responsible representatives of optometry are working in Washington to correct this mistaken amendment in the Social Security Act. Our representative in this matter is Dr. Franklin M. Foote. Optometric leaders do not like the present wording of the amendment any better than we do.

"3. Legal representatives of optometry and opticianry are assisting our committee. Legal representatives of the American Medical Association do not seem inclined to do so.

"4. The improvement of interprofessional relationships with reference to referral of patients seems to be, as stated 'really a matter of following the Golden Rule or putting these matters on a decency basis.'

"5. 'Joint efforts to offer improved educational opportunities for the training of undergraduate optometry students in the recognition of possible ocular pathology.' This has been begun in a number of instances. The way to this interprofessional educational exchange was opened by the action of the American Medical Association previously mentioned.

"6. Discourage unfair or 'spite' articles in the legitimate publications. This is highly desirable, but its accomplishment will require time, publicity and increased tolerant understanding.

"The chairman and, I believe, the other members of the Interprofessional Committee on Eye Care are of the opinion that this committee has made some progress in improving interprofessional relations in the several groups involved in eye care. We believe that such a committee forms a useful liaison between these various groups. We believe, too, that such a clearing-house type of committee can assist greatly in ironing out the rough spots in interprofessional relations. The less strife and conflict we have in interprofessional relations, the better will be the service rendered to the patient by the several groups. This would be a definite advance in public health."

B. *Committee on Research in Visual Acuity in Myopia*

The Committee reported that it has continued its investigation of the effect of training by the Renshaw technic on the visual acuity of myopia patients. An analysis of data submitted to the statistician last October on 52 trained cases and 26 controls revealed an apparent small gain in visual acuity in the trained cases. One interesting finding was the apparent progression in myopia as judged solely by visual acuity of the control group while the trained group failed to show an increase in myopia over a period of six months. However, it was believed that an insufficient number of cases had been observed to be statistically significant.

C. *Committee on Testing Eyes of School Children*

Dr. Post's report was accepted with appreciation and the Committee continued.

D. *Subcommittee to Cooperate with Council on Physical Medicine* (Dr. Hughes, Dr. Prangen)

The following report was accepted and the committee was continued:

"Since the last meeting of the American Committee on Optics and Visual Physiology in October 1951, the Committee to Cooperate on Ophthalmic Devices of the A.M.A. has not held any meetings or circulated any formal communications. A few routine matters have been discussed between the Council and the Chairman and one formal report has been submitted on the 'Comparison of the Keystone Visual Survey Tests using the No. 46 Telebinocular (Keystone Co.) with Standard Ophthalmological Technics.'

"Briefly, this study was carried out at the Illinois Eye and Ear Infirmary by Dr. Margaret Abrahamson and the Resident Staff on 116 individuals of varying degrees of intelligence and the data were recorded on the School Survey Cumulative Record Form No. 3 provided by the Keystone Company. It is not implied from these comparisons in a relatively small number of cases that statistical proof is offered of differences between the Keystone apparatus and other methods of ophthalmological examination. No estimation of test-retest reliability and the importance of age, intelligence, ocular pathology, skill of the technician and other factors has been made. Enthusiasm for the project waned in the face of apparently innumerable variations.

"The impression from this study is that a rather high degree of over-referral would result from the Keystone Visual Survey Test, particularly in regard to visual acuity, fusion and color perception. The vertical muscle balance tests of the Keystone apparatus appear to be significant. The greater variability of horizontal muscle balance comparisons is to be expected because of the greater test-retest variability with any single instrument for this measurement. The greater esophoria for near obtained with the Keystone instrument is a common finding when the instrumentation becomes more complex and stimulates overconvergence. In view of this variability, the classification of these horizontal phorias as 'underconvergence' or 'overconvergence' on the Keystone record form might imply a pathologic condition which does not really exist or is inconsequential when other factors of binocular motility are considered."

E. *Subcommittee on Optotypes*

The following report was accepted and the committee continued.

"This Subcommittee was appointed to explore the possibilities of working out the geometrical and decimal systems (for the desig-

nation of visual acuity) in a practical manner.'

"The discussion of the problem by the members of the committee has been carried on entirely by correspondence. A preliminary review of the problem prepared by the chairman of the committee was first submitted to the committee members and this review furnished the basis for the correspondence. The following notes sum up the reactions of the various members of the committee to the problem.

These notes therefore do not constitute a final recommendation of the committee.

"The chief points that came out of the discussion are as follows:

"1. Although visual acuity charts are used primarily in the procedure of determining refractive errors of patients, it is strongly felt that the integrity of such charts for a reasonably accurate determination of visual acuity should be preserved.

"2. The opinion seemed to be that the use of the Snellen notations, such as 20/30, 5/6 or 14/16, are admissible only if the visual acuity measurements have been made at 20 feet, 5 meters or 14 inches, as indicated by the numerator of the fraction. To apply the designation 20/20 to visual acuity measured at 10 feet or at 14 inches is considered incorrect usage.

"3. Although there is yet no published experimental proof that a geometrical progression in the sizes of the letters of successive lines of the chart represents a physiological attribute of visual acuity, the majority of the committee seemed to feel this progression was desirable. A physiological basis for a geometrical progression might be found in the relationship between uncorrected refractive errors and visual acuity. The data available in the literature tend to show a geometrical progression, but the spread of the data between the various experimenters is such that a determination of the magnitude of the geometrical progression is not entirely satisfactory.

"4. A study of the problem shows that it is impossible to work out a *uniform* decimal system (on the basis that the decimal is equal to the numerical value of the Snellen fraction) for designating the visual acuity of charts in which the sizes of the letters of successive lines change in a geometrical progression. Only if the decimals (or numbers) used are purely arbitrary can such a system be employed, and then these are useless for conversion or interpolation unless tables are resorted to.

"5. The objection most frequently applied to the decimal system is that a given decimal always tends to connote a *percentage of normal vision*, from which one immediately computes the percentage of loss of vision. This is quite untrue and is often very misleading.

"6. The decimal system which has for its basis the assumption that 1.00 represents 'normal' vision is a misstatement of fact, for the 'normal' or average visual acuity of eyes is better than 1.00. It is unfortunate that the term 20/20 has become a fetish in the popular mind.

"7. The basic factor of all visual acuity testing is the resolving power of the eye, and the test letters of the chart and the *International* test object, the Landolt ring, are designed to measure insofar as possible that resolution. *Most of the members of the committee feel strongly that visual acuity should be stated in terms of the angle of resolution directly (in minutes of arc), the quantity that is measured.* Such a designation would be automatically International. A little thought will show the obvious advantages of such a system. Conversion to any of the presently used systems, meters or feet, centimeters or inches, can be made mentally. A visual acuity of 2.3 in the English system would be 20/46, or in the metric system 5/11.5. One need only multiply the numerator—the test distance—by the visual acuity angle to obtain the denominator. Lack of present usage and unfamiliarity only argue against its adoption. It should be noted that the new visual acuity clinical test chart designed for the Armed Forces has the angle notation on one side of each line of test letters of the chart.

"8. In the event that the suggestion of paragraph 7 is not acceptable—and it would take time and the work of many to make it acceptable—the consensus of the committee seems to be that *no standard International designation system should be adopted.* The present decimal system is understood generally, irrespective of the meter or foot systems. It causes no embarrassment to any individual. In other words, the consensus of the committee seems to be that there is nothing to be gained by adopting a standard decimal system and that the present situation should be left as it is.

"9. Finally, it was felt by several members of the committee that the particular choice of letters in the lines of the visual acuity chart was a much more serious problem. Some of the members of the committee have rather definite ideas on this matter, those ideas being based upon the great amount of research that was done during the last war. This problem is probably outside the province of the work of the present committee, however.

"These above remarks are not to be taken as the final recommendation of the committee, but they do indicate the trend of thought of its various members. In the final report the data or proofs for these topics will be presented."

The committee is comprised of Dr. Kenneth N. Ogle, chairman; Col. Victor Byrnes, Dr. Alfred Cowan, Comdr. Dean Farnsworth, Dr. Gerald Fonda, Dr. James Lebensohn, and Dr. Louise Sloan.

F. *Committee on Contact Lenses*

The Subcommittee on Contact Lenses has continued to investigate the corneal type of contact lens. Although most of the committee's experience has been with the Tuohy Corneal Lens, a few cases wearing the lacrimal lens and the Paracurve lens have been observed. Although more cases of the latter two types should be followed, it would appear that better results follow the use of the Tuohy lens.

Experiences with the corneal lens are reported in a paper by Drs. Girard, Foree and Berens presented at the meeting of the American Ophthalmological Society, June 5, 1952, in Hot Springs, Va.

Advertising of the corneal type lenses (invisible lens) which has appeared in newspapers throughout the country is to be deplored. Statements leading the reader to believe that the lens can be worn indefinitely in all cases have not been substantiated by clinical investigation.

The above report was accepted and it was voted that the committee be continued and be asked to study the corneal lens.

The designation of a screening test for color vision was tabled to the fall meeting. Dr. Ogle asked to bring it up again at that time.

The publication of a scientific paper on corneal lenses and a lay publication for Today's Health is to be passed upon by Dr. Post and Dr. Swan.

The reconsideration of lighting standards was tabled until the fall meeting, the review of tentative school lighting standards set by the University of the State of New York to be included.

Dr. Prangen was reappointed by the American Ophthalmological Society as a member of the American Committee on Optics and Visual Physiology for a period of three years (1952-1955).

It was voted that the American Academy of Ophthalmology and Otolaryngology be asked to reappoint Dr. Frederick C. Cordes whose term expires in 1952.

It was voted that Dr. Gerald Fonda be proposed to the American Medical Association for appointment as member on the American Committee on Optics and Visual Physiology.

The letter from Dr. Pascal regarding standardization of the term "meter angle" was referred to Dr. Burian for report in October at the Academy meeting.

Dr. Burian reported on the publication of the translation of Tschermak's book on Physiological Optics. The publisher reports that it will not appear until the fall.

REPORT OF AMERICAN ORTHOPTIC COUNCIL

FRANK D. COSTENBADER, M.D.
Academy Representative

The Seventeenth annual meeting of the American Orthoptic Council was held in Chicago on October 13, 1951, with Dr. Murray McCaslin, President, presiding. Drs. George Campion, Frank D. Costenbader and Kenneth C. Swan represented the American Academy of Ophthalmology and Otolaryngology.

During the year 1951-52, Dr. Costenbader has served as Secretary-Treasurer of the Council, as chairman of the committee on orthoptic evaluation, and as ex-officio member of the committee on symposium program and of the committee on examinations. Dr. Kenneth Swan has served as chairman of the committee on nominations, and on the committee on instruction and the committee on ethics. Dr. William Krewson has served on the committee on publications.

The significant activities during the year 1951-52 were:

1. The annual intensive course for orthoptic technicians was held for eight weeks in St. Louis with an enrollment of 26 students.
2. The annual symposium for opthalmologists and orthoptic technicians was presented before the American Academy of Ophthalmology and Otolaryngology in October 1951. Papers by Dr. S. Rodman Irvine, Miss Dorothy Bair, Dr. H. Saul Sugar, and Miss Alice McPhail presented an excellent survey of intermittent exotropia.
3. At the annual examination of orthoptic technicians, 33 were examined and 30 were certified. The general level of interest and academic attainment of candidates is gratifyingly good.
4. The American Association of Orthoptic Technicians reports an increase in membership to 167. Four well-attended sectional meetings covering the Northeast, Southern, Midwest, and Western sections of the country presented excellent programs during the year.

5. The first issue of the American Orthoptic Journal, under the editorship of Dr. Richard G. Scobee and Miss Mary Argue, appeared in the fall of 1951, and will be followed by annual issues of increasing size and breadth of material.
6. Instruction courses for orthoptic technicians at the time of the American Academy of Ophthalmology and Otolaryngology meetings were available for the first time, under the sponsorship of the Academy and the American Orthoptic Council. These courses were well attended and enthusiastically received, and are expected to be a permanent feature in the continuing instruction of technicians.
7. To further learning in the field of orthoptics, the American Orthoptic Council proposes:
   (a) that an instruction manual be formulated,
   (b) that advanced certification of technicians after graduate study be investigated, and
   (c) that a survey be undertaken to "evaluate orthoptics."

The officers elected for the year 1952 were:
President, Dr. Avery D. Prangen, Rochester Minn.
Vice-President, Dr. Richard G. Scobee, St. Louis, Mo.
Secretary-Treasurer, Dr. Frank D. Costenbader, Washington, D. C.

The American Orthoptic Council deeply regrets the loss of Dr. Walter B. Lancaster, a long time member and former President and earnest worker for the Council.

A similar loss has been sustained in the death of Dr. Richard G. Scobee in June 1952. Dr. Scobee was extremely active as Vice-President, Chairman of the Committee on instruction, and was the first Editor of the American Orthoptic Journal.

The American Orthoptic Council is pleased with the efforts of the American Association of Orthoptic Technicians as well as its own efforts in basic as well as graduate instruction of orthoptic technicians. However, as always, these activities are not self sustaining.

Your Committee respectfully recommends (1) that the American Academy of Ophthalmology and Otolaryngology continue its financial support of the American Orthoptic Council in the amount of $100.00 to be used specifically for its basic instruction course for orthoptic technicians, and (2) that the American Academy of Ophthalmology and Otolaryngology continue its sponsorship of the American Orthoptic Council, and that it reappoint Dr. Frank D. Costenbader for a period of three years.

REPORT OF THE CONSULTATIVE PANEL ON TUMOR TERMINOLOGY OF THE AMERICAN SOCIETY OF CLINICAL PATHOLOGISTS

JOHN S. MCGAVIC, M.D.
Academy Representative

Since the Consultative Panel on Tumor Terminology of the American Society of Clinical Pathologists has been dissolved, I have nothing to report and suggest that appointment of a representative to this Panel be discontinued.

REPORT OF THE JOINT COMMITTEE ON INDUSTRIAL OPHTHALMOLOGY

A. D. RUEDEMANN, M.D., Chairman

As stated in our previous reports, the activities of the Joint Committee on Industrial Ophthalmology are devoted to the main objectives of research, education and counseling service to industry and individuals seeking information.

The section on Industrial Ophthalmology is appearing regularly in the issues of the TRANSACTIONS of the American Academy of Ophthalmology and Otolaryngology. A continuing bibliography (consisting to date of over 3,000 references) is carried on as a regular feature of Committee activities and is published in the TRANSACTIONS. Kodachrome slides of eye injuries are being accumulated and are available for lecture purposes upon request. Requests for information are answered through the office of the secretary and personal consultations are arranged whenever feasible.

A special evening program was given on October 12 during the annual meeting of the Academy. Papers presented at this meeting will be published in forthcoming issues of the TRANSACTIONS.

The award for special services was presented to Dr. Albert C. Snell, Sr., in appreciation of the work he has done for Industrial Ophthalmology. He was the first chairman, really organized the work of the Joint Committee, and has continued his support in all of its activities.

A survey of Second Injury Funds was made last year at the request of the Pan-American Association of Ophthalmology. It is appearing in the Journal at Dr. Alvaro's request and also in the TRANSACTIONS.

A very comprehensive study of "Tinted Optical Media" was made at the request originally of the Council on Physical Medicine and Rehabilitation of the American Medical Association. Serving on the Subcommittee were Dr. John L. Matthews, Chairman, Lt. Comdr. Dean Farnsworth, V. Everett Kinsey, Ph.D., and Col. Victor A. Byrnes. The results of their efforts have been incorporated in a special statement. Because of the urgency of the problem and since the Council on Physical Medicine and Rehabilitation admitted it would be a long-time study project, it was agreed to publish the statement simultaneously in the National Safety News, the Journal of Industrial Medicine and Surgery and the TRANSACTIONS of the American Academy of Ophthalmology and Otolaryngology. Reprints of this report have been widely distributed and responses indicate a genuine appreciation of this authentic information. Further investigation of the problem of tinted lenses for night driving is on the agenda of the Committee at the present time. This problem has recently been accelerated by nationwide publicity in favor of yellow lenses.

Our association with the Council on Industrial Health has been stimulated by the realization that pamphlets on modern standards for industrial lighting are needed and that the American Medical Association standards on the "Appraisal of Loss of Visual Efficiency" should be revised.

The support of the American Academy of Ophthalmology and Otolaryngology and the American Medical Association has been much appreciated in the past and has done much to further the work of the Joint Committee in its efforts to help industry solve problems of eye protection and medical care. It is hoped that the work of the Committee will continue to merit that support.

Financial Statement:

Joint Committee on Industrial Ophthalmology

Balance, September 15, 1951			$ 702.33
Receipts:			
January 10, 1952, American Academy of Ophthalmology and Otolaryngology			500.00
			1,202.33
Disbursements:			
Memberships:			
Illuminating Engineering Society	$ 15.00		
Industrial Hygiene Association (dues)	6.00		
Central States Industrial Medicine	15.00		
Industrial Hygiene Association (subscription)	25.00		
American Public Health Association	15.00		
National Safety Council	12.00	$ 88.00	
Reprints for distribution		80.31	
Postage		14.85	
Lantern Slides		9.23	
1951 Convention Expense:			
Dr. Kuhn	118.68		
Mrs. Connor (secretarial)	48.95		
Subcommittee:			
Transcript of Conference	38.90		
E. V. Kinsey	35.00		
Capt. Schilling	35.00	276.53	
Annual award, C. W. Schilling (1951)		175.00	
Mimeographing expense		16.50	
Secretary Ruth Connor, attendance at National Society for Prevention of Blindness annual meeting and Midwest Safety Council—follow-ups for Dr. Kuhn		117.73	
Bank charges		1.67	779.82
Balance, September 15, 1952			422.51

INDUSTRIAL OPHTHALMOLOGY

INTRODUCTORY STATEMENT

We have in this edition of the TRANSACTIONS *two very excellent papers. One is a careful description of an eye protection program as set up in a major industry through the combined efforts of the medical director and the consulting ophthalmologist. It is being presented here to enable ophthalmologists interested in the details of such a procedure to find the answers.*

Those of us who have been working with visual testing equipment in industry are fully aware of the possibility that a considerable number of individuals who would show normal central vision with the battery tests, administered as they are, might still have glaucoma. The combined efforts of all parties interested have failed to produce equipment which could be turned over to lay technicians for reliable fields. We still hope the day will come when something can be devised. The responsibility of trying to find those individuals who do not know they have glaucoma has been hanging heavy over general practitioners and ophthalmologists who know that there may be undetected cases. An effort to meet this situation was developed by Dr. Conrad Berens who with C. P. Tolman devised a very simple instrument that would roughly determine whether intraocular tension was below normal, about normal or above normal. In the hands of some individuals using this equipment experimentally, excellent results have been obtained. Several revisions of the instrument itself have been made including magnification which still is not quite adequate. There are those who have not gotten good results, but by and large, the reports have been good. A young ophthalmologist, working with a large civilian population in a military installation, has proceeded with an investigative problem in the attempt to pick up those individuals over 40 who, even though they have normal vision, might have an increase in intraocular tension. The results of this very carefully carried out bit of practical research conducted under the supervision of Brigadier General Otis B. Schreuder and carried out my Major Buesseler is presented in the hope that it will encourage other people to attempt the evaluation of the Berens-Tolman tonometer as part of a testing program in industry for individuals over 40 who with the battery instrument appear to have normal central vision.

HEDWIG S. KUHN, M.D.
Secretary, Joint Committee
Industrial Ophthalmology

EYE PROTECTION PROGRAM

DOUGLAS J. WOOD, M.D.
and
HOWARD KOHN, M.D.
CLEVELAND, OHIO

THE building of armored military vehicles presents a great potential eye injury hazard throughout a great number of the manufacturing processes. Molten metal splattered from heavy welding operations, flying chips from grinding and milling machinery, and moving objects which may strike workers, are ever-present eye hazards.

Although there have been many ideal eye protection programs suggested by numerous authorities in this field, the purpose of this article is to present an account of the program developed at the Cleveland Tank Plant.[1,2] Although no single feature of this program can be considered original, it is believed that the comprehensive scope of the program is unique. The results certainly have been extremely successful.

Since the start of operations of the Tank Plant, on August 26, 1950, the employe population has increased from an initial nucleus of 55 executives to a total of nearly 7000 employes. It has been transformed from a farm surplus

The authors are Medical Director and Ophthalmology Consultant, respectively, of the Cleveland Tank Plant, Cadillac Motor Car Division, General Motors Corporation.

warehouse to a heavy manufacturing industry. The phrase "From Beans to Battle Wagons" aptly describes the situation.

In view of the potentially great eye injury hazards, management decided to require all personnel, whether directly engaged in the manufacturing processes or not, to wear specified eye protection upon entering all manufacturing areas. The Safety Department stipulated that a safety goggle with metal side shields, or the equivalent, be worn. These goggles are equipped with the best quality precision safety lenses available, and comply with the American Standards Specification.

The requirement of 100 per cent eye protection has been accomplished but not without difficulty. One of the first tasks confronted was to convince top-management of the necessity for a program which appeared to many people as being elaborate, expensive, and impractical. At the same time, the cooperation of line supervision had to be obtained, and employes had to be educated to the need for eye protection.

The nature of the employe population at the plant made the development of the program particularly difficult. The great proportion of employes have been a part of the organization for less than a year. Many employes were recruited from areas in which standards for eye care are very low.

The presence of large numbers of employes of outside contractors in the plant during remodeling and machinery installation further complicated the matter. Although these individuals did not originally come within the jurisdiction of the plant's Safety Program, it finally became necessary to compel them to wear Safety goggles for their protection, as well as to maintain the morale of employes of the Tank Plant.

PROCEDURE FOR OBTAINING AND MAINTAINING SAFETY GOGGLES

Upon being hired, an employe is temporarily issued a plastic shield which serves as eye protection until he can be fitted with the permanent type safety goggle required for his job. As soon as possible, he returns to the Safety Department and is fitted with stock safety goggles. This fitting is accomplished by a skilled optician. The employe is advised, that if the goggles should become uncomfortable or require adjustment at any time, he is to return to have them re-fitted.

These safety goggles are issued without charge to the employe for his use while employed at the Tank Plant. Upon termination of employment, the goggles are returned as company property. He is informed, that the goggles are optically neutral and when properly fitted, do not in any way affect or injure the eyes.

If the employe wears prescription eye glasses, he is issued a special plastic shield to wear over them. These shields are generally intended as a temporary device, although they may be used permanently. The employe is informed that experience has shown, that the most satisfactory method of protecting his eyes is to purchase a pair of safety goggles ground to his prescription.[1]

If he has a prescription which is satisfactory, he may submit it to the optician who orders prescription safety goggles for him and selects his proper frame size. If his prescribed street glasses are satisfactory, the optician may duplicate the prescription from the glasses with a lensometer and then order the safety goggles. If the optician doubts that this prescription or the street glasses are satisfactory, he may advise re-examination by an eye specialist of the employe's

choice. The employe is informed that he may have his eye examination performed by the ophthalmologist who is available at the Plant Medical Department. If the Medical Department has noted that the employe is in need of visual correction at the time of pre-employment examination, he is advised to have his eyes examined by an eye specialist.

The purchase of prescription safety goggles is partially born by the Tank Plant, in that the employe pays for the prescription and for the lenses that are obtained, while the plant pays for the frames and the cost of fitting. This results in a very small cost to the employe for prescription ground safety goggles which becomes his personal property. He is informed that the cost varies with the amount of eye correction necessary and the type of lens selected.

To enable employes to keep safety goggles free of dust and dirt, goggle cleaning stations are located at strategic places throughout the plant. They are instructed to keep goggles clean and are advised to handle them carefully so that they will not be twisted out of adjustment, and so obtain maximum eye protection and comfortable service from the goggles.

PROBLEMS PECULIAR TO THE FITTING OF SAFETY GLASSES

All employes at this plant are required to wear a metal-framed, side-shielded, safety goggle with case hardened lenses. By the very nature of this requirement, fitting is difficult and expert attention is required. It is essential to have proper clearance of the shields from the brow and face so that shields do not press and become uncomfortable, yet they must be close enough so that maximum protection is afforded. As a result of the side shields, some employes are troubled with mild claustrophobia. Because the frames are malleable, they must be re-adjusted from time to time as necessary. Due to the fact that the goggle is somewhat heavier than the ordinary dress spectacle, the nosepiece must be carefully fitted.

The lenses are made of stock frequently twice the thickness of ordinary spectacle glass, which of course, increases the weight of the safety goggle. The glass is tempered according to American Standards Specifications G.G.G. 50 as revised in 1948.

In order to obtain the greatest field of vision, a -6 base curve is utilized. This curved surface also provides for greater protection in that it tends to deflect direct blows. However, certain optical problems are immediately encountered. This lens does have an isoikonic factor to the glass. There is no refractive power yet the image size is definitely changed. For employes who have been wearing spectacles ground on a different base curve, this element may introduce some discomfort. The employe who has never worn glasses may find the change in image objectionable when required to wear Plano goggles.

In the process of case hardening of the lens, there is a small amount of warping in the glass which may introduce a slight cylindrical error. This is generally of an insignificant degree. However, in a very discriminating individual, such may be intolerable. The leading manufacturers of safety goggles have developed a method of individually tempering their lenses to minimize this problem. They check each lens and reject if beyond the tolerance required. This is an excellent argument for obtaining a high grade of safety goggle which, though initially expensive, pays off in the long run. In the case of the

less expensive goggle, the manufacturer cannot afford to reject such lenses. It is also noteworthy that because of the warping problem, it is not practical to apply the case hardening process to concave lenses of strength greater than -6.

It is a requirement of the American Standards, that any lens must have a minimum of 3 mm. thickness at its thinnest point. The lens must be case hardened to resist the 7/8 inch steel ball test dropped from 50 inches. It must be mounted in a nonflammable frame, such as metal or cellulose acetate plastic. It must bear the trade mark of the manufacturer.

Due to the added thickness, there is an appreciable amount of light absorption from safety glasses, making it possible for a certain number of people who are comfortable with their present visual acuity to notice an increased eye strain on wearing safety goggles. This is frequently true in the case of the employe who has never worn glasses, yet has tolerated a certain amount of refractive error, and upon being required to wear safety glasses, develops discomfort.

Thus a hidden refractive error is manifested. He is very frequently a difficult person to convince that he should wear safety glasses. Intelligent handling on the part of the ophthalmologist, the industrial physician, the optician, the safety director or anyone else the employe contacts in regard to this problem is very essential. It is so easy for a practitioner, who is not sympathetic towards eye protection or aware of the problems of a manufacturing plant, to advise an employe against the wearing of safety glasses, thus doing an employe a great disservice.

Because of the inherent annoying factors in the safety goggle, we have found that even small inaccuracies in the prescription will not be tolerated and will give immediate complaint, whereas, such may not have given discomfort in a more readily accepted dress spectacle. This applies especially to the employe who wears a dress spectacle with an inaccurate correction even though of a minor degree. It also applies to the individual with an undetected refractive error of small or appreciable amount of degree who has not been accustomed to wearing glasses at all.

ADVANTAGES OF A QUALIFIED OPTICIAN WORKING IN THE PLANT ON A FULL TIME BASIS HANDLING SAFETY GOGGLES

No safety goggle program can be considered adequately administered without the provision for comfortably fitted safety goggles.[2] No amount of discipline will be effective unless the employe is equipped with glasses with which he is completely satisfied. The mechanical fitting of the goggle to the employe is just as important as securing the correct prescription in the glass. This cannot be accomplished by an untrained individual who has been given a pair of pliers and a few words of instruction. He must have a thorough knowledge of practical optics, the various lens types and bifocal segments. He must be proficient in the use of such equipment and tools as are required for the checking, fitting and repairing of safety goggles. Haphazard dispensing of safety goggles is bound to bring unsatisfactory results.

The trained optician should dispense all safety goggles that are issued and make necessary adjustments to them whenever needed. He is required to handle the repairs and sterilization of goggles. He issues goggles according to the job requirements which have been set up by the Safety Department; such as issuing tinted goggles for use in welding areas, or avoiding special types of side shields and bridges.

He is in charge of ordering prescription ground goggles. This may be from a prescription brought in by an employe from an eye specialist, or if the employe has satisfactory dress glasses, he may duplicate the prescription and order the safety goggle lens without delay. The latter requires skill in the use of the lensometer. He also uses the lensometer to check all prescription goggles before final issuance to the employe.

The optician must have experience and judgement. He must be able to select cases that are in need of refraction (even if their visual acuity appears to be within normal limits). He must be able to determine whether the prescription submitted by the employe is recent enough to be satisfactory.

He instructs the employe in the wearing of special goggles. He must be very adept in the problems that are encountered in the fitting of safety goggles, knowing how to handle the problem of the wide bridge and any others that may arise. Safety goggles are probably the most difficut type of spectacle to be fitted.

He is the first line of defense in the complaints arising from the wearing of goggles, many of which he is able to solve by simple adjustments or instructions. He must be able to determine special requirements of a special job, knowing when and why an employe has difficulty with his goggles. New machinery may require a different type of safety goggle, or even a new prescription from that for which the employe has to wear a bifocal lens.

During the year 1951, 1,242 prescription goggles were handled by our optician. Of these, 685 were prescriptions issued by ophthalmologists performing refractions in the Plant Medical Department. The remaining 557 were either prescriptions brought in by the employe or obtained by duplicating prescriptions on the lensometer from satisfactory street glasses, recently prescribed to the employe.

He must be diplomatic at all times. He must have professional bearing in his dealing with employes if the 100 per cent eye protection program is to be a success.

ADVANTAGES OF A QUALIFIED OPHTHALMOLOGIST PERFORMING REFRACTIONS IN THE PLANT

To simply tell an employe to go out and get his eyes examined and bring back a pair of glasses which will correct his vision is of little value. It is known that many 20/20 eyes are improperly corrected, resulting in failure to relieve visual fatigue. The best possible arrangement is to have an ophthalmologist, who is familiar with the working conditions and the visual problems of the plant, be designated to perform refractions required for safety goggles.[2] He must be provided with the essential equipment to perform this task. Such an arrangement makes his services attractive to the employe.

The fact that such services are available is a great factor in promoting the Safety Goggle Program. The ophthalmologist prescribes according to the requirements of the employe and his job, recommending the proper strength or the type of glass required. He is available for adjustments in complications arising from the wearing of Plano or prescription goggles, which the optician is unable to handle.

At this plant approximately 10 hours per week are expended in performing his service. It is accomplished by two ophthalmologists, who each spend a half a day of their schedule in the plant.

The provision of suitable equipment, secretarial and accounting services for collection of fee-for-service rendered through payroll deductions permits establishment of a fee schedule which is

attractive to both the ophthalmologist and the employe.

By having refractions performed in the plant, a great deal of hardship to the employe is saved. One can count on 2 to 3 trips out of the plant during working hours in order to obtain a prescription for safety goggles which are suitable. It is to be remembered, that this plant is engaged in national defense work, requiring a 6 day week, 8 or more hours per day for the employe. Therefore, conservation of man hours has been of utmost importance. Consequently, a possible 1½ days of lost time has been reduced to less than one hour per man. During the past year, possibly 10,000 man hours have been conserved, considering the number of prescription safety goggles arranged for.

PROBLEMS OF THE OPHTHALMOLOGIST

As previously mentioned, extreme accuracy in refraction is required. The overall strength of the glass should be adjusted according to the job requirements, especially in reference to the working distance, as for example, the task of the machinist who has to perform very close work, in contrast to the crane operator, who must have very sharp distance vision. In the first instance, the lens must give as much aid to accommodation as possible, whereas, in the second case, the lens must provide accuracy for distant vision with less regard for accommodative assistance.

An employe wearing a bifocal lens may require a strength that is different from his personal glasses because of the working distance involved in his job. In general, we try not to use a different type of lens from that to which the employe has been accustomed. However, in some cases, a different bifocal or trifocal might be required, as in the case of the man whose work requires looking upward a greater part of the time, and so must have a segment in the upper part of the lens.

Many complaints about the wearing of safety goggles have to be solved by the ophthalmologist. This is true of the employe who is wearing a goggle with an incorrect prescription. Another source of complaint, results from the employe wearing a Plano goggle, when he actually has an uncorrected refractive error giving rise to asthenopic symptoms.

In addition to mechanical and refractive obstacles encountered when enforcing a safety goggle requirement there are psychological barriers. There is the resentment on the part of the employe who has never worn goggles. Such an employe is very much inclined to attribute any pathological condition to the safety goggle. A common nuisance is for a middle-aged employe to develop presbyopic symptoms during the period that he has been wearing Plano goggles, a condition entirely related to the aging process of the eye. Similarly, other conditions such as, chronic conjunctivitis, blepharitis, hordeolum, chalazion, lens opacities, none of which could be related to the wearing of Plano goggles, are attributed by the employe to the enforced use of them. The true cause of such conditions must be carefully explained to the employe.

Anisometropia presents a problem when an attempt is made to raise the vision of the nondominant eye to plant requirements. This will be tolerated with more or less facility depending on the amount of the anisometropia, the age of the employe and his psychological make-up. In general, such situations have to be handled with extreme caution, and it is usually not well to bring the vision of the nondominant eye up to equal the dominant eye even when

such is possible. In any event, the situation has to be carefully explained. The employe must be told that, although he may experience discomfort, the vision will not be harmed. If these changes cannot be tolerated, corrective measures can be taken. This reassurance may make possible these attempts to improve visual acuity.

There are presbyopic individuals who have been getting along using a single type of lens, but now in order to perform the job satisfactorily, must use a bifocal. Such cases require tactful consideration on the part of all concerned.

In the prescribing of cylinder lenses for the employe who has not previously worn glasses, it may be essential to sacrifice some degree of visual acuity by either incompletely correcting the astigmatism, so as to avoid annoying changes in image size and position, or to arbitrarily set the cylinder axis at 90° and 180° to avoid tilting of images thus preventing a very dangerous situation. Although these objectionable optical effects may be overcome by continued wearing, many of these employes will only wear corrective glasses on the job, thus allowing the effects to persist and be hazardous. The ophthalmologist must guard against over-zealous attempts to increase visual acuity by changing astigmatic correction from that previously worn and similarly obtain undesirable results.

The ophthalmologist must check strength and fit of the goggles whenever essential in the event that the optician cannot satisfy the employe. He must be on guard for any inaccuracies in either the lens or the frame.

Filtering lenses such as the calabar type must be prescribed for the employe assigned to welding. In the case of individuals working near the welding areas but not directly engaged in welding, lighter shades of filtering lenses may be utilized to protect against occasional exposure to welding flash. For this situation Cruxite lenses are frequently advantageous since the lens does have ultraviolet filtering qualities, yet does not unduly interfere with visual acuity.[3]

It is a frequent occurrence for the ophthalmologist to detect pathological conditions of the eye during the routine examination for prescription goggles. The detection of such conditions is a service to both the employe and the employer. The employe may be advised so that corrective action may be instituted by an ophthalmologist of his choice. On the other hand, if the employe has been attributing discomfort to safety goggles, the true nature of the complaint is readily pointed out, and the reputation of the safety goggle is not further blemished.

PATHOLOGICAL FINDINGS IN THE COURSE OF 685 REFRACTIONS

Adnexa

(a) Cicatrix of the tear duct, 1; (b) chronic blepharitis, 5; (c) chalazion, 2; and (d) papilloma of lid, 2.

Conjunctiva

(a) Chronic conjunctivitis, 5; (b) conjunctival varices, 1; and (c) pinguecula, 1.

Cornea

(a) Central leucoma of cornea, 3; (b) corneal dystrophy, 2; and (c) imbedded corneal foreign body (of several days' duration), 1.

Muscles

(a) Severe convergence anomalies, 3; (b) incipient muscle paralysis, 1; (c) strabismus, 4; and (d) vertical muscle imbalance, 2.

Pupil

(a) Ectopia pupillae, 2; and (b) paralysis of pupil, 1.

Vitreous

Floaters and hyaloid remnants, 3.

Lens

Opacities and cataract, 5.

Retina and Choroid

Chronic chorioretinitis, 3; retinal venous aneurysm, 1; retinal angiospasm, 1; premature arteriovenous nicking at age 32, 1;

cystic retinopathy, 1; premature senile macular pigmentation and degeneration, 9; macular cyst, 1; and melanoblastoma of choroid, 1.

General Disease

Cerebral accident, 1; diabetes, 1; anemia, 1; allergy to homatropine, 1; and migraine, 3. Central Nervous System: Amblyopia exanopsia, 6; bitemporal hemianopsia from intracranial neoplasm, 1.

Although intraocular tension is routinely tested by palpation, no positive diagnosis of glaucoma has been made to date. This is probably related to the age distribution of the employes of this plant.

SAFETY RECORD, 1951

CLEVELAND TANK PLANT

Statistics from "Accident Facts," a magazine published annually by the National Safety Council, show that during the year 1950, approximately 1,950,000 disabling industrial injuries involving lost work time were reported throughout industry in the United States.[4] Three per cent of the compensation paid for these industrial injuries was paid for eye injuries.

The Ohio Commission for Safety and Compensation reported that in 1949 (the latest study available) a total of 271,156 claims were filed for industrial injuries. Of these claims, 51,924, or 19.1 per cent were for eye injuries; 3,272 of these claims were for injury to both eyes; 48,652 were for injury to one eye. A total of 170 claims for total loss of vision were made.

No work days have been lost as a result of eye injuries since the plant began operating on August 26, 1950. No compensation has ever been paid for eye injury.

During 1951, 1,568 employes reported to the Medical Department for treatment of eye conditions alleged to be from occupational causes. The types of injuries included: foreign bodies in the eye, welding flash, dust irritation, conjunctivitis, and eye conditions said to be related to the wearing of safety goggles. Of all these cases, only one was severe enough to require the patient to wear an eye patch for more than 24 hours.

Almost hourly, employes report to either the Medical or Safety Departments with safety goggles that have become pitted or have sustained fractured lenses. Serious injury has obviously been averted by the goggles in most of these cases.

During 1951, eighteen employes of the Tank Plant became eligible for membership in "The Wise Owl Club." This is a national organization with the requirement that the employe in a member industry, must have averted an extremely serious eye injury as a result of wearing proper eye protection. Investigation of the accident must reveal beyond any doubt that severe disabling eye injury would have occurred.

Following is an analysis of the causes of each of the 18 accidents occurring to these "Wise Owl Members":

Eyes Saved	*Cases*
a. Flying pieces of metal—broken drills, chips	9
b. Explosion of grinding wheel	2
c. Flying slag or hot metal from welding splatter	4
d. Splatter of hot caustic solution	1
e. Striking region of eye against stationary sharp-pointed projection on ventilating duct -	1
f. Direct blow from sharp pointed tool (file)	1

That the 100 per cent eye protection program is effective becomes evident when one realizes that, had each of these accidents resulted in lost vision to one eye, a total of $72,450 would have been paid under the Ohio Compensation statutes.[5] Had just one of these accidents resulted in lost vision to both eyes

of a 25 year old man, a total of $64,983.46 would have to be paid in weekly disability compensation payments and medical expenses to the individual.

The total cost of the eye protection program at the Tank Plant for the entire year of 1951 was less than either of the sums used above as illustrated.

CONCLUSION

The record at Cleveland Tank Plant indicates that a 100 per cent eye protection program can be successful. This program has not only accomplished its primary objective of procuring the greatest degree of eye protection for the employe, but in addition has greatly enhanced employe-employer relationships and provided a great economic saving to the plant operation.

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GLAUCOMA DETECTION PROGRAM AT WRIGHT-PATTERSON AIR FORCE BASE

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GLAUCOMA AS A NATIONAL PROBLEM

IT is the opinion of most ophthalmologists as well as of the Ophthalmologic Foundation of New York, that glaucoma is the principle cause of blindness in the United States. Its victims make up 12 per cent of the 160,000 totally blind persons in this country, or an aggregate of 31,000 Americans. Each year 2,600 persons lose their sight from this disease.[1]

A survey of 10,500 adult industrial workers over the age of forty years, made by the Philadelphia Committee for Prevention of Blindness, revealed that 280 persons, or 2.7 per cent of the total group, possessed previous undiagnosed ocular hypertension. Only 4 of the entire 10,500 workers knew they had glaucoma. On the basis of these figures, it is estimated that approximately one million adult Americans have glaucoma and do not know it.[2]

GLAUCOMA DETECTION IN THE UNITED STATES

Because blindness from glaucoma can usually be prevented or arrested by early diagnosis and treatment, the problem with which we are most concerned is principally one of early glaucoma detection. In this regard, "wide angle" or so-called chronic simple glaucoma poses the public health problem. There is no pain or visual disability in the early stages of this disease. However, an increase in ocular tension, most frequently of only a relatively mild degree above normal, is a measurable early sign. It is upon this sign that early detection is primarily based.

Unfortunately, the instrumental measurement of ocular tension as a routine part of an examination has in the past been delegated almost completely to the ophthalmologist. He has, therefore, borne the major burden for glaucoma detection and, to him, the disease has long been a source of concern, largely because its victims reach the eye physi-

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cian frequently after far-advanced and irreversible damage has been done to the visual apparatus.

To prevent these often repeated tragedies of late diagnosis in glaucoma, the Ophthalmologic Foundation of New York, with the energetic guidance and assistance of Dr. Conrad Berens, has launched a plan for the prevention of blindness from glaucoma through cooperation between ophthalmologists and other physicians. The program is based on dissemination of information and organization of intraprofessional teamwork in glaucoma detection, under the supervision of ophthalmologists through the auspices of their respective county medical societies. Intraprofessional cooperation is essential because general practitioners and other physicians see probably one hundred times as many patients as do ophthalmologists.[1] Their opportunity to detect elevated ocular tension is therefore proportionately greater.

As an aid in facilitating the screening of patients for possible ocular hypertension, the Ophthalmologic Foundation has developed the Berens-Tolman Ocular Hypertension Indicator.[1] This relatively sturdy and inexpensive plastic and metal instrument can be carried in a doctor's pocket or medical bag for ready availability on the occasion of any examination. It is the incorporation of ocular tension determinations into the physician's routine for physical examination which is most desired and necessary for early glaucoma detection. For this screening purpose, the Berens-Tolman Ocular Hypertension Indicator is designed for direct reading to indicate simply whether the ocular tension is low, normal, or high, and, if high, whether it has reached any emergency stage.[1] Prompt referral of any suspected cases to an ophthalmologist is the completing link in the intraprofessional detection program.

GLAUCOMA DETECTION IN THE AIR MATERIEL COMMAND

In view of the great significance of blindness to the individual working man as well as to the national welfare, it is only natural that industrial medicine concern itself with the glaucoma problem. The Air Materiel Command is in many ways similar to a large industry, and, as such, has progressively developed and improved the preventive and occupational health services for its civilian employees. Besides having placed special emphasis on the early diagnosis of such disorders as diabetes and hypertension, the command has directed particular consideration toward the industrial eye care program. As evidence of some of the progress made in this field since the last Air Materiel Command report given at the twenty-ninth meeting of this committee in November of 1951, the Ortho-Rater has become universally used for vision testing in the preemployment and the five-year multiphasic physical examinations. In addition, the command has instituted illumination studies and the establishment of illumination standards for specific job requirements and work areas.

Recently, a plan for glaucoma detection was added to the eye care program. Its significance may be gathered from the fact that the Air Materiel Command currently employs approximately 170,000 civilian workers. Of these approximately 25,000 are situated at Wright-Patterson Air Force Base. It is estimated that the employees in these groups over the age of forty years number approximately 71,000 and 10,500 respectively. On the basis of previously mentioned statistics,[2] 2.7 per cent of these groups, or 1,928 persons in the Air Materiel Command and 280 persons at Wright-Patterson Air Force Base, presumably possess undiagnosed ocular hypertension.

The Ophthalmologic Foundation's screening program for glaucoma detection[1] was considered to be outstandingly well suited for adaptation to the industrial medical facilities and functions of this military establishment. The testing program has thus far been limited to Wright-Patterson Air Force Base in order to determine its most effective means of application before extending the plan as standard procedure to the remaining portions of the command.

At this base, the screening of civilian employees for glaucoma is conducted by the civilian physicians of the Preventive and Occupational Health Services Dispensary using the Berens-Tolman Ocular Hypertension Indicator. The testing is incorporated into the routine of the pre-employment and five-year multiphasic physical examinations of persons over forty years of age. In addition, a check list of present employees over the age of forty years has been made, and these individuals are currently being called in alphabetic order in small groups of six or eight each day for testing with the Berens-Tolman Ocular Hypertension Indicator. Although the program is still in its infancy at this installation, 7 cases, or 2.9 per cent of abnormally elevated ocular tension have already been found among a total of 238 persons tested over forty years of age. To date, only five persons have refused to undergo the simple test.

Each person found to have ocular hypertension is informed of the findings in his case and advised of the importance of obtaining further evaluation and care from an ophthalmologist as soon as possible. To facilitate the transfer of the case to an ophthalmologist and to allow the employee a free choice of physicians, the individual concerned is given a list of all the diplomates of the American Board of Ophthalmology who conduct practice within a reasonable driving distance of this Air Base. The employee is urged to select any one of the listed ophthalmologists and is given a form letter of introduction which explains to the ophthalmologist the purpose of the patient's visit and requests that an abstract of the ocular evaluation be returned to the Preventive and Occupational Health Services of Wright-Patterson Air Force Base.

It is hoped that as the survey progresses, not only at Wright-Patterson Air Force Base but also in the rest of the installations of the Air Materiel Command, enough data will be accumulated to be of statistical significance in further evaluating the problem of asymptomatic glaucoma and glaucoma detection.

SUMMARY

A brief statistical review of glaucoma as a cause of blindness in the United States and of ocular hypertension as an asymptomatic finding in persons over forty years of age, has been presented.

The program for intraprofessional cooperation in glaucoma detection and the Berens-Tolman Ocular Hypertension Indicator as sponsored and developed by the Ophthalmologic Foundation of New York was described in basic principle. An adaptation of the Ophthalmologic Foundation's glaucoma screening program for use by the Preventive and Occupational Health Services of the Air Materiel Command, and at present being utilized at Wright-Patterson Air Force Base, was introduced and a preliminary report of initial data presented.

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1952

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PHYSIOLOGY

S. RODMAN IRVINE, M.D.
BEVERLY HILLS, CALIF.

IN this symposium my part would seem to be to answer the question: "What physiologic factors must the examiner keep in mind when confronted with a patient with intermittent exotropia?" The title "Intermittent Exotropia" implies a certain limitation in the classification of exotropia, but from an etiologic viewpoint the underlying causative factors are probably the same for constant exotropia and for intermittent exotropia.

For example, if movement of the two eyes is restricted by orbital pathology, the position of the eyes could conceivably be exotropic in some positions of gaze and esotropic in others. With lesions involving the posterior part of the median longitudinal fasciculus, there may be normal convergence and yet paralysis of adduction of either or both medial rectus muscles leading to an apparent intermittent exotropia. In myasthenia gravis it is commonly noted that the position of the eyes on cursory examination is one of parallelism, but involvement of the medial rectus may result in exotropia when the patient directs his gaze in a field requiring the use of that muscle. These far-fetched anatomic and innervational causes of intermittent exotropia are cited to show that your program chairman, in choosing the title, realized that the problem of divergence excess, convergence insufficiency, or both, is much more involved than would be implied had he named in the title these entities commonly cited as the basis for intermittent exotropia.

The criteria of these clinical entities are well known and need not be listed. The etiologic factors involved, usually cited in textbooks, need only enumeration:

1. *Anatomic factors:* (a) variations in the lateral positions of the orbits and asymmetry of the orbits, (b) shallowness of the orbits as seen in faulty development of the skull leading to hyperteleorism, (c) proptosis and enlargement of the globes embarrassing adduction and convergence, and (d) fascial and muscular anomalies of the extraocular musculature.

2. *Innervational factors:* (a) deficient convergence impulses as a consequence of myopia, (b) reduced visual acuity from refractive error or other cause, particularly if uniocular, (c) inattention in fatigue, (d) sleep and deep anesthesia, (e) low pitch of convergence tone and high pitch of divergence tone, and finally (f) faulty development of fusional binocular reflexes as a result of any of the above-mentioned abnormalities with consequent faulty sensory adaptation, such as suppression and anomalous retinal correspondence. In our treatment of such cases we attempt to correct the abnormal sensory adaptations first and thus effect a cure. One must then postulate that, theoretically, these could have been the primary causes of the divergence.

It is generally assumed that there is a center for convergence and that this is located in Perlia's nucleus in the third

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nerve nucleus complex. Lesions affecting this directly, or afferent impulses to it, could readily result in convergence excess or convergence insufficiency. Many authors assume the existence of a similar center for divergence and locate it near the sixth nerve nucleus because the clinical entity of divergence insufficiency or paralysis has resulted from lesions demonstrated to be in this area.[7] Other authors deny the existence of such a center because no area in the brain has been found which, when stimulated with an electrode, produces divergence. It is believed by some that divergence is brought about passively by the normal elasticity of the divergent orbital structures plus the active inhibition of convergence—an explanation which makes divergence comparable with the passive relaxation of accommodation. If the criterion for the existence of a center is an accumulation of cells which when stimulated produces a complicated coordinated physiologic response, then even the center for convergence has been found wanting.[11]

The factors listed as having a possible bearing upon the etiology of intermittent exotropia may form a general pattern of consistency in any series of cases, but the exceptions are such that these general causes do not give a satisfactory explanation for the whole mechanism involved. For example, it is not rare to see widely separated eyes with no significant refractive error, showing orthophoria, normal convergence, and no evidence of excessive divergence. Exophthalmos does not always lead to exophoria and convergence weakness. Again, we see congenital unilateral lesions of the macula in eyes showing apparent orthophoria. We see no incidence of myopia in divergence excess that is consistent with the theory of deficient convergence impulses as a consequence of the myopia. Cass[1] reported a series of 88 patients with exotropia; of those cases due to divergence excess, 71.5 per cent were emmetropic, none were myopic, and 14.5 per cent were hypermetropic; of those due to convergence insufficiency, 45 per cent were emmetropic, 17 per cent were myopic, and 34 per cent were hypermetropic.

The position of the eyes in sleep, although generally believed to be divergent, is quite variable, judging from reported observations.[8] Under anesthesia the position varies with the depth and type of anesthesia. With pentothal sodium the eyes tend to be forcibly elevated and divergent. In anoxemia they tend to be convergent.

Haessler[5] has shown that the phoria position of the eyes, whether divergent or convergent, is unrelated to the degree and facility of divergence and convergence.

Obviously, the cause of intermittent exotropia is not known and it remains for me to discuss certain physiologic concepts and some personal observations that may have a bearing on the problem.

Anatomically the alignment of the eyes in the orbits is such than an exotropic position would exist if other factors were absent. The orbit and the muscle cone make an angle of approximately 25 degrees with the sagittal plane of the head. In many ungulates the eyes assume a position of divergence at all times and the field of vision is thereby enlarged so that the animal is better protected from an approaching enemy. In man, whose eyes show progressively discriminatory visual acuity from the periphery of the retina to the fovea, the eyes instead of being divergent are convergent at all times when both foveas are fixing the same object. Complicated innervational reflexes give proper tone to the eye muscles, altering and maintaining their position on the object of attention. The basic inborn compensatory fixation reflexes or gravitational

reflexes, whose afferent arc is the proprioceptive impulses from the neck and the labyrinth, constantly readjust tone, yoke the eyes together, and hold them in the primary position as the head or body is moved. In the decerebrate animal these basic gravitational impulses move the eyes opposite to head movement in a mechanical, doll-like fashion. Their tone is altered for purposes of better coordination by the cerebellum. It is also affected by more basic impulses as noise and pain, causing the eyes to turn in the direction of such stimuli. Allied with these postural gravitational reflexes are the retinal orientation fixation reflexes that also affect conjugate movement of the eyes and fixation. These reflexes require sight. The sensory organ is the retina and the afferent arc, the retinal fibers. We speak of the reflex of "regard" as causing the eyes to turn toward a stimulus in the periphery of the retina; the "following" reflex as causing the eyes to follow a moving object; and the "fixation" reflexes. The centers for these involuntary and unlearned reflexes are in the occipital lobe. Lesions around the superior colliculus may paralyze voluntary movement of the eyes but they will still move in response to the "following" reflex. With such lesions the eyes cannot shift fixation from one object to another voluntarily, yet they may be made to turn in any direction by either moving the fixation object slowly or rotating the head passively while fixation is being maintained; it is as though the eyes were locked in a state of obligatory fixation. An inhibitory reflex from the cortex is required to suspend the prevailing fixation long enough to allow it to shift in response to a visual stimulus impinging upon a peripheral portion of the retina. Thus the postural gravitational reflexes and the orientation retinal reflexes serve to keep the eyes conjugately fixed in respect to gravitation and orientation points respectively. Vergence reflexes develop later in the phylogenetic scale and correct for orientation from distance to near. They produce both horizontal convergence and divergence, and vertical and cyclovergent movements. These vergence reflexes probably have both innate and conditioned (learned) aspects. Once the object of attention is fixated, additional minute movements of fixation constantly move the eyes about the point of fixation for searching and studying the object, moving the retinas so that one receptor and then another is stimulated as receptors become fatigued and refractory.

Next in development we have the binocular fusional reflexes bringing about a different type of convergent, divergent, or vertical binocular adjustment in response to stimuli from disparate points on the retina that are being visualized. The movements are executed slowly and there is a persistence of the induced position for some time after the stimulus has been removed. These achieve the binocular stereoscopic image and, of themselves, have a steadying effect on eye movements. They are involuntary and doubtless, in part, are conditioned or learned reflexes. The facility with which these reflexes can be learned varies from individual to individual, and the so-called "absence of a fusion center," all other things being equal, could simply be a lack of ability of the nervous mechanism to be conditioned. Finally the voluntary reflexes, centered in the frontal lobes of the cerebral cortex, exert a dominant tone on the underlying basic reflexes, inhibiting or stimulating so that the eyes may be moved in response to volition.

From a physiologic standpoint, when we speak of a center for this or that activity we mean simply that there is a localized area in the brain which, on stimulation, produces a certain complicated

reflex response. Being complicated, it necessarily is the station wherein many afferent or efferent nerve fibers have converged to a point at which a single stimulus can produce the complicated response. There are many activities that do not require such a convergence of afferent or efferent impulses and consequently would have no so-called center, and yet their physiologic activity would not suffer.

In other words, there can be divergence tone without postulating a divergence center. Such an active divergence tone is necessary in fusional movements to overcome latent esophoria, as Bielschowsky has stated.

Nervous impulses are then constantly bombarding the motor nuclei of the eye muscles and, in turn, through these, the eye muscles themselves, with varying tone of these muscles in the living eye resulting. It becomes impossible to stimulate a "position of rest" of the eyes except in ophthalmoplegia, curare poisoning, or death. The question then arises, do the eyes assume the position of the orbits, namely 25 degrees of divergence, in death? This has been assumed and it has been disputed,[9] and as far as I know, no one has determined the orbital axes and position of the eyes just before and just after death. It has also been impractical to correlate the heterophoria existing during life with the position of the eyes after death. Compilation of such measurements would enable us to understand better the effect of divergence of the orbits on divergent strabismus. Relating orbital measurements and racial types to phorias and strabismus would be a most interesting study. Flanagan, Hill and Kvernland,[4] taking action currents off the eye muscles, failed to record activity during the resting state and postulated a toneless state of the eye muscles in the living eye. In view of the concept of innervational tone just described, this work bears repeating with multiple electrodes, to pick up tone impulses. We should determine whether or not, in divergence excess, there is excess tone in the lateral recti as compared to the medial recti. If the resting muscle does not record action potentials, this cannot be determined, but here again is a field for investigation. Duke-Elder has shown, by recording action currents, that the ganglion cells in the retina reach a refractory state quickly in curarized animals. Does this mean that minimal vibration from extraocular muscle tone moved the electrode to a different cell, or in some way affects a cell that is unaffected when the muscles are completely paralyzed?

At one time Ludvigh and I[6] presented evidence that the usual criteria for proprioceptive senses were found wanting in the extraocular muscles. We also noted differences in anatomy and physiology between eye muscles and other muscles and explained their plastic tone, allowing for fine adjustments of movement, as compared to the tone of unstriated muscle. Since then proprioceptive sense organs have been found[2] and typical proprioceptive action currents have been recorded from eye muscles,[3] so that many of the concepts explaining visual phenomena on the basis of absence of proprioceptive sense may have to be altered.

As these fundamental problems are solved, our explanation of divergence may better explain all types of cases. I recently saw a man, 54 years of age, who presumably had normal eyes until he suddenly became aware of diplopia and showed a divergent strabismus of 45 degrees. He could converge momentarily and had normal retinal correspondence. We operated on this man four times, doing bilateral recessions of his lateral recti as well as bilateral resections of the medial recti, and succeeded in only partially correcting his exotropia. To say this man did not have divergent tone

and that divergence in this case was but a passive response to lack of convergence would be unreasonable. All ophthalmologists have seen cases of divergence that responded poorly to operative changes in the position of the globes, and they have seen other cases of equal degree overcorrected by the same procedures.

For diagnostic purposes I have injected novocain into extraocular muscles to partially or completely paralyze them, lessening the innervational tone of the muscles, and then observed the effect on the squint. One 26-year-old army sergeant had an external strabismus from childhood; it amounted to 35 prism diopters for distance and 10 to 15 prism diopters for near. Convergence could be fairly well maintained and he had what appeared to be binocular vision for near. He had normal retinal correspondence and simultaneous macular perception, but no fusion. There may have been a small central inhibitory scotoma in the left eye. The left lateral rectus was injected with novocain, paralyzing the muscle so that the eye could move only 4 prism diopters to the left. Even with this paresis there persisted approximately 2 prism diopters exotropia for distance in the primary position. On turning the eyes to the right, 10 prism diopters of exotropia persisted, without diplopia, whereas on turning the eyes to the left there was immediate esotropia and double vision. It is interesting that the exotropia persisted in the right field even though the medial rectus of the left eye was unopposed by the left lateral rectus. Ordinarily, on conjugate deviation to the right, the left lateral rectus would presumably be inhibited anyway, but by the injection we were certain of inhibition and still had excess tone of the external rectus of the right eye in conjugate deviation causing divergence.

We have all seen examples of marked exotropia when the patient is looking down, with relative orthophoria in the primary position or on looking up. I recently saw such a case, a 30-year-old woman with binocular vision and unlimited convergence and a pupillary distance of only 58 mm. She obviously had bilateral paresis of the inferior recti. She had always been aware of diplopia at times but it did not bother her. She volunteered that on going out into bright light she usually shut one eye. Her explanation of this was indefinite—the light was too bright, or perhaps the bright extra image was too difficult to inhibit. Operation revealed definitely abnormal adhesions, resembling fibromas, around the junctions of the inferior obliques and inferior recti on both sides. Freeing the adhesions and shortening the inferior and medial recti partially corrected the condition. I have seen similar cases, and I am quite sure that some exotropia cases are the result of bilateral weakness of the inferior recti or superior recti, lessening the adductive power of these muscles.

Another interesting case has been followed since 1931. At the age of 2 this little girl had an alternating esotropia for near. At the age of 7 her eyes were straight under cover, and then at times would turn in 50 prism diopters. Refraction revealed approximately 2.50 D. of hypermetropia in each eye. Visual acuity was normal. When she was 12 the patient had exophoria under cover for distance and near and a near point of convergence of 17.5 cm. Through orthoptic training she developed good amplitude of fusion, overcoming 50 prism diopters base out to 3 prism diopters base in. It was noticed that she fixed binocularly for distance and tended to shut her right eye for near work, but with plus 2 spheres for near work she had binocular vision for reading. At 18 she had definite exophoria for distance and esotropia for

near, but with her reading glasses she had binocular vision for near. At the age of 22, she had 20/20 vision in both eyes; refraction: O.D. -0.37 cyl $\times$ 90 and O.S. $+0.25-0.37 \times 70$. With these glasses she had 6 diopters of exophoria for distance and esotropia for near. Unilateral accommodation showed 11 diopters accommodation for either eye, but binocular accommodation was less than 1 diopter. With a plus 1.75 add she had binocular vision for reading. Here then is a case which showed variable esotropia and exotropia because of insufficiency of binocular accommodation. The change in the patient's strabismus with age shows how absence of one link in the binocular reflex system can produce a variable type of strabismus, depending on anatomic and innervational factors.

Finally, I might call attention to a case of typical divergence excess in a girl of 25 showing normal vision without refractive error, normal convergence power for close work, and apparent binocular vision for close work with intermittent exotropia when looking in the distance. At times the eyes are straight and at other times one eye drifts out. On the synoptophore the patient showed a large facultative scotoma at the angle of squint, false projection between this area and the macula, and apparently little fusion. Many times she would project homonymously when the maculas were stimulated simultaneously, yet, when looking at the Snellen chart, she could hold her eyes together and fusional movements could be elicted by placing prisms in front of her eyes. The afterimage test showed both normal and abnormal retinal correspondence, the patient at times seeing a cross and at other times seeing the vertical or horizontal lines separately. Under certain circumstances, as in strong sunlight, the patient squinted one eye. Yet she showed marked inhibition of diplopia when tested with the amblyoscope. With a Maddox rod, looking intently at the light and the red line, and having been told their approximate distance from her, she showed only 5 or 6 prism diopters of exophoria with no evidence of suppression. Yet, when tested on the synoptophore she showed marked suppression. What does this mean? We get the impression that under certain circumstances of gaze and attention, normal binocular reflexes are operating and rapid cover test and Maddox cross elicit only a slight degree of exophoria. The binocular reflexes have locked the eyes together, so to speak, as in the normal individual. Yet, under other conditions of attention, such as when day-dreaming, or when the eyes are covered with certain instruments, or on prolonged occlusion, there is reversion to the more primitive type of vision, the two eyes acting as unrelated units.

We see a similar phenomenon produced experimentally in patients with cataracts, who have used one eye for some time, allowing the more cataractous eye to diverge. After both cataracts are removed and glasses are prescribed, there may be 20 to 30 prism diopters of divergence. With very little practice and training, binocular vision is achieved, and then when one measures the phorias in the usual manner one finds them reduced to the usual range, not the extreme degree manifest immediately after surgery.

This brings us to the question of sensory adaptation in intermittent exotropia. I am sure you are aware that there are all degrees of change, some cases showing normal retinal correspondence, fusion amplitudes and stereopsis when converging binocularly, yet when fixing monocularly, showing suppression at the angle of squint, with normal to false projection between this area and the macula, and sometimes inattention at the macula, similar to the inat-

tention used when looking into a monocular microscope. At other times the patient sees both macular images equally well and projects them to the right and left fields. Occasionally one finds a scotoma at the macula or there is alternate suppression, the patient seeing first the right and then the left image, interpreting the position of the images homonymously no matter where placed, there being no spatial relationship between right and left images. In some cases peripheral fusion seems normal but patients are unable to superimpose foveal images, one overlapping the other, moving about slightly without actual fusion taking place. Theoretically, the more abnormal the retinal correspondence the more difficult the case would be to treat, and yet it is surprising how this correspondence may appear to vary, depending on the test used to determine it. One is often misled into thinking a case is going to be difficult to correct, only to find it surprisingly easy after surgery. The most difficult cases to treat seem to be those associated with marked vertical imbalance, which cannot be explained as a function of divergence alone, those with complete paralysis of convergence, and those who anatomically show laterally placed eyes as judged by the position of the internal canthus farther forward than the external canthus.

Finally, since the anatomic factors are not consistent, since convergence and divergence seem to be independent of the phorias, since the refractive changes do not explain the problem, and since developmental factors resulting in faulty learning of binocular reflexes do not apply to intermittent exotropia where retinal correspondence is normal, I am inclined to agree with those who believe that convergence insufficiency is simply a lack of convergence tone which responds well to orthoptic treatment; that divergence excess is a reversion to an atavistic type of innervation of the eyes,[10] and that this alone or in combination with convergence insufficiency is best treated by both surgery and orthoptics.

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DIAGNOSIS AND INCIDENCE

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As an introduction to this paper, may I say that diagnosis of strabismus is primarily the province of the ophthalmologist; the treatment depends upon proper diagnosis. It is the privilege and responsibility of the ophthalmologist in referring cases for orthoptic treatment to make the diagnosis and recommend corrective measures.

Diagnosis is important to the orthoptic technician for the same reason that it is important to the ophthalmologist — that is, proper understanding of the deficiencies of each individual case, so that treatment may be undertaken in a direct manner with no time lost on unnecessary maneuvers. It was a lack of understanding of the results of diagnostic procedure which at first led technicians to promise miracles and ophthalmologists to expect them. This phase is past. We now have a good idea of what is possible and what is not, and we try to act upon that knowledge.

Comitant exotropia is divided into three classes, the convergence insufficiency type, the divergence excess type, and a combination of divergence excess and convergence insufficiency.

The convergence insufficiency cases are the easiest to understand and the most rewarding to treat orthoptically, but the divergence excess cases are by far the most interesting and challenging, even though in the majority of the cases the nonsurgical treatment is not directed toward a "cure" but is pointed toward preparing the patient to be able to get a more lasting result from surgery. This latter group, the divergence excess type of intermittent exotropias, is the group with which this paper is concerned.

The characteristics of divergence excess are as follows[2]:

1. Exophoria or exotropia is greater for distance than for near.
2. The deviation is intermittent, varying with visual attention, state of health, and position of fixation.
3. The near point of convergence is normal and the prism convergence is ample for near.
4. Prism divergence may be normal or excessive for near, while the measurements of prism divergence for distance are difficult because of frequent suppression.
5. Amblyopia of any degree is rare.
6. There is almost constant suppression at distance.
7. Normal retinal correspondence is present for near, while at times abnormal retinal correspondence can be demonstrated for distance, although usually suppression interferes or questionable correspondence is present.
8. The refractive error usually is not significant.
9. Visual confusion frequently is present.

The rest of this paper is an elaboration on these characteristics with their incidence, and an explanation of the tests which we use in determining or qualifying each.

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In studying the incidence of the various factors in intermittent exotropia, I took the first 1,000 cases of squint in our files. Of these, 210 or 21 per cent were cases of divergent strabismus. Of these 210, there were 76 cases of divergence excess and 50 cases of divergence excess combined with convergence insufficiency. My figures for incidence will not always agree with these totals, since in many cases the patients were too young for certain tests.

Deviation

The patient may have either exophoria or exotropia at 20 feet and be exophoric, exotropic, or orthophoric at 13 inches, but his measurements will be less for near than for distance. He may even vary between exophoria and exotropia within one period of examination. He may be obviously exotropic while playing about the office or sitting quietly while the history is being taken, but when examined, the eyes may be straight at distance and near until covered. This variability of deviation may be determined roughly by casual observation and verified by actual measurement.

In the divergence excess cases the average deviation for 20 feet was 29 prism diopters, and for near, 9 prism diopters, or a difference of 20 prism diopters between distance and near. In the combined divergence excess and convergence insufficiency cases, the average deviation for distance was 19 prism diopters, and for near, 13 prism diopters, or an average difference of 6 prism diopters.

There are many methods of measuring the deviation, but we usually use one of the following:

a. The *corneal reflex* test of Hirschberg is useful in very small children and in patients with a high degree of amblyopia and poor fixation. A light is held at about 13 inches from the patient's eyes. The corneal reflex will be centered in the fixing eye and decentered in the nonfixing eye. Allowing for angle kappa, the measurement can be approximated in this test by estimating six or seven arc degrees of deviation for each millimeter the reflex is removed from the center of the cornea of the nonfixing eye.

b. The *prism reflex* of Krimsky gives a similar result. The light is presented at about 13 inches from the patient's eyes and prisms of increasing strength are held base in before the fixing eye until the corneal reflex is centered on the nonfixing eye. The strength of the prism needed to center the reflex is approximately the angle of exotropia, although here again the angle kappa must be considered.

c. The *prism and cover* test is the most accurate for measuring a deviation. The patient fixes a light at distance or near, and prisms of increasing strength are placed base in before the eyes, the examiner covering the eyes alternately until all movement is stopped. The amount of prism necessary to stop fixation movement of the eyes is the measurement of the exotropia.

Intermittency

Intermittency is that condition which exists when the squint alternates from no gross deviation to obvious exotropia from one minute to the next. The occurrence of this characteristic is nearly always obtainable from the history of the case and may be elicited by careful questioning of the parents. It is usually noticeable during the examination.

Near Point of Convergence

Of the 76 cases of divergence excess, all had good convergence. If not, they would have been classified as divergence excess combined with convergence insufficiency.

The test for the near point of convergence is done by moving a small fixation object toward the nose and measuring the distance at which fusion breaks. A pencil point may be used for adults, but we find that this does not interest small children and they will do much better with a small picture or some other object of interest. We use a white-headed pin on which there have been placed two small black dots. This pin is stuck into the eraser of a pencil, which is rotated as it approaches the nose, so that first *one*, then *two*, then *no* dots are visible to the patient. The child's interest is held because he is counting the dots as they appear.

Prism Convergence and Divergence

Prism convergence and divergence are difficult to measure at distance in most cases because of suppression and lack of fusion. For near, the prism convergence is good and the prism divergence is from normal to excessive.

We use loose prisms, the prism bar, and the rotary prism, but the rotary prism has proved best for our purpose since it gives a smoother transition in increasing the prism strength. The patient has a greater amplitude if he does not have to regain fusion each time the prism is increased.

A small light or a black dot on a white background is fixated at 13 inches, and the prism is rotated base in or base out until fusion breaks. This is the break point. The prism strength is then decreased until the patient is able to regain fusion. This is the recovery point.

The tests for convergence and divergence should not immediately follow each other since there is a definite lag of convergence following divergence, and vice versa.

Amblyopia

Amblyopia of more than slight amount is very rare in divergence excess because of the intermittency of the squint. Frequently, however, the visual acuity in the nonfixing eye cannot be improved to better than 20/30. For the purpose of this paper, a difference in visual acuity between the two eyes of more than one line on the Snellen vision chart was considered a significant amount of amblyopia.

In the patients who were too young to allow measurement of visual acuity, we accepted fixation readings; when central fixation is not good, the eye is considered amblyopic. Of the 126 patients in the series, only 11 were amblyopic to any significant degree, 8 as a result of anisometropia, 1 because of a cataract, and 1 because of macular degeneration, leaving only 1 patient in 126 that could be said to have marked amblyopia from disuse.

Suppression

Almost invariably suppression is found at 20 feet in intermittent exotropia, but seldom at 13 inches. In this series, there was either monocular or alternate suppression in every case when the eyes were divergent. While suppression fields were done on only a few cases, suppression areas were probably present both in the macula of the deviating eye and in the retinal area having a common visual direction with the fovea of the fixating eye.

The tests for suppression which we use most commonly are:

a. *Major amblyoscope:* Similar targets with check marks are aligned before the foveas of the two eyes. The check mark before the suppressing eye will disappear, and at times the whole target will disappear. Upon moving the arms of the machine to and fro, the target before the suppressing eye will appear first on one side then on the other side of the target before the fixing eye. The extent of the disappearance is the extent of the area of suppression.

b. *Lancaster red-green:* This test is also used to map out the area of suppression. The patient is seated 2 meters from a gridded screen. The patient is wearing red-green spectacles and a red light is projected at the center of the screen for him to fix. The green light is then moved back and forth across the red light and is reported by the patient as disappearing as it approaches the red light. This is a more accurate way of mapping the suppression area than by use of the major amblyoscope, since the light can be easily moved and the area measured in all meridians.

c. *Worth 4-dot:* This test may be done at 20 feet or at 13 inches. A pair of red-green spectacles is placed over the patient's eyes, the red lens over the right eye. The fixation object consists of four lights, two green, one red and one white. If the patient is suppressing the right eye behind the red lens, he sees three green lights; if he is suppressing the left eye behind the green lens, he sees two red lights; if he is not suppressing and is divergent, he will see five lights—two red and three green; if he is fusing, he sees four lights. This test may be varied by covering any of the lights, and *should* be varied because it is a fixed test and the patient's desire to please plus his good memory may elicit false answers.

Retinal Correspondence

In intermittent exotropia, when tested at 20 feet, normal retinal correspondence, abnormal retinal correspondence, or confused retinal correspondence may be present because of the nature of the squint. When tested at 13 inches, normal retinal correspondence is usually present.

If a test approximates the conditions of everyday use, the response will show the manner in which the patient uses his eyes for casual seeing. If the test is not related to the conditions of everyday usage, the patient is more likely to demonstrate his innate retinal correspondence. Thus, as Dr. Burian[1] has stated:

> If a patient responds in all tests with anomalous correspondence, we can assume that his anomalous correspondence is very deeply rooted. If he responds with an anomalous correspondence in certain tests but not in others, we can assume that the anomalous correspondence is only more or less superficially established.

The afterimage test bears no relation to the habitual use of the eyes and so will usually demonstrate the innate normal correspondence. The major amblyoscope and the red-glass tests more nearly approximate the everyday usage of the eyes. They are, therefore, more likely to show any tendency toward abnormal retinal correspondence which the patient may have developed.

In the 90 patients whose retinal correspondence could be determined, the findings were:

NO. OF CASES	PERCENTAGE OF N.R.C.
For Distance	
58	64
5	6
27	30
For Near	
87	97
3	3

Retinal correspondence is tested in one or all of three ways.

a. *Major amblyoscope:* Dissimilar targets are placed in the major amblyoscope, for instance, a lion before one eye and a cage before the other. The patient is asked to set the arms of the machine so that the lion appears to be in the cage. He may do one of two things. He may say that the lion is in the cage, or that the lion disappears as it passes the cage. This is the *subjective* measurement of his alignment, the angle at which *he thinks* his eyes are aligned. His eyes are then alter-

nately covered, and if there is no shift, he is using the fovea of each eye in conjunction with the other. If there is a shift, the operator moves the arms of the instrument until there is no shift on alternate cover and records this as his *objective* angle. The difference between the subjective angle and the objective angle is called the angle of anomaly. If the angle of anomaly is zero, that is, if the subjective and objective angles are the same, normal retinal correspondence is present. If there is an angle of anomaly of more than 5 diopters, that is, if there is a difference of more than 5 diopters between the subjective and the objective angles, there is probably an abnormal retinal correspondence. If the patient has normal retinal correspondence, then second and third grade targets are used to test his fusion, stereopsis, and amplitudes.

This same test should be done for near by placing —3.00 lenses in the eye pieces of the instrument. I mention this because while many cases of divergence excess will have abnormal retinal correspondence or complete suppression of the image at distance, they will have normal retinal correspondence with good third degree fusion at near.

b. *Afterimage test of Hering:* A lighted filament is presented horizontally before one eye for 30 seconds while the other eye is covered. The filament is then presented vertically before the second eye for 30 seconds while the first eye is covered. The patient is then instructed to close his eyes and describe or draw the afterimage which he sees. If the horizontal and vertical lines appear in the form of a *cross*, there is normal retinal correspondence; if in any other form, there is abnormal retinal correspondence.

c. *Red glass:* The patient looks at a light with the red glass over one eye. The resulting diplopia is measured, and the measurement corresponds to the subjective angle. If this angle equals that of the prism and cover test, there is normal retinal correspondence. Quite often, especially in intermittent exotropia, there is monocular or alternating suppression at distance. This may usually be overcome by placing before one eye a prism base up or base down of sufficient strength to take the image out of the area of suppression. Base out or base in prisms are then used until the higher image is directly above the lower one. The same result may be obtained by using a base in or base out prism before one eye to approximate the angle of squint. If, then, the images are not approximately together, the patient has an abnormal retinal correspondence.

d. *Lancaster red-green:* The patient is placed 2 meters from the gridded screen and is given red-green spectacles. The operator throws a red light on the screen and the patient is asked to superimpose the green light which he is holding. If the angle between the two lights corresponds to his angle of squint, he has normal retinal correspondence; if not, he has abnormal retinal correspondence.

Refractive Error

This part of the diagnosis does not fall within the province of the orthoptic technician, so I shall not elaborate on the technics of refracting.

Cycloplegic refraction was not done on all patients, but of the 114 which were refracted the cycloplegic acceptance was as follows:

CYCLOPLEGIC ACCEPTANCE	NO. OF CASES	PERCENTAGE
Within normal limits (Emmetropia to + 1.50S)	65	57
Hypermetropia of 2 diopters or more	34	30
Myopia of any degree	15	13

From this we may judge that refractive error is not too significant and that myopia probably is not a significant etiologic factor in these cases.

Visual Confusion

There are many kinds of visual confusion: closing one eye in the bright light, rubbing one eye, diplopia, annoyance, photophobia.[3] These symptoms, which suggest an incomplete awareness of two eyes, may nearly always be elicited while taking the history.

There was a history of visual confusion in 77 or 61 per cent of the patients examined.

Age of Onset

The average age of onset of divergence excess was 1.8 years; for divergence excess combined with convergence insufficiency, it was 1.9 years, whereas the average duration of the squint before the first examination was 2.8 years for the divergence excess types and 4.5 years in the combined types. This would seem to suggest that the factor influencing the development of secondary convergence insufficiency is duration of squint before treatment rather than early age of onset. This is borne out by the fact that in the large majority of patients seen in the first year after onset, there was good convergence, but by the time they had reached the age of readiness for orthoptics, a convergence insufficiency had developed.

SUMMARY

In this presentation I have attempted to show that in intermittent exotropia (1) the divergence is greater at distance than at near, (2) suppression and retinal correspondence vary with the deviation and (3) the onset of intermittent exotropia is early, while the secondary convergence insufficiency increases with age.

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Symposium: Intermittent Exotropia

TREATMENT

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The treatment of strabismus is ultimately to give a straight position of rest to the eyes. This may be accomplished by strengthening fusion and improving amplitudes and/or changing the position of rest of the eyes.

In our discussion we will use the term "intermittent exotropia" to include only the following two types of comitant exotropia: the pure "divergence excess" type and mixed divergence excess with secondary convergence insufficiency.

The treatment of the pure divergence excess type of intermittent exotropia includes (a) optical treatment and near work stimulation, (b) orthoptics, and (c) surgical treatment.

In the more or less "pure" case, where there is no evidence of convergence insufficiency, treatment depends upon the age of the patient and upon how conspicuous the deviation is. When the deviation is very occasional in a patient under the age of 5 and is cosmetically satisfactory, I advise observation of its frequency by the parents, who report to me at the yearly examinations, and delay actual treatment as far as orthoptics and surgery are concerned. Orthoptics, in my hands, is not usually worth while before the age of 5 and is even better after 6. If convergence insufficiency appears and progresses, treatment is indicated at any age. Usually a divergence excess measuring 20 prism diopters at 20 feet will require surgery.

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DIVERGENCE EXCESS

Optical Treatment

Moderate or small hypermetropic refractive errors, which are the most common, should not be corrected, but myopia should be corrected fully or even overcorrected. Overcorrection stimulates the accommodation and prevents or delays secondary convergence insufficiency. Overcorrection is very useful in young children but may cause severe asthenopic symptoms in young adults. An interesting recent example of its effect in adults occurred in the case of a 32-year-old orthoptic technician who was able to control fairly well 20 diopters of exotropia with the following: R - 2.50 + 0.75 × 110; L - 2.25 + 1.00 × 70. She complained of pain in her right eye. Her refractive error under homatropine was: R + 0.50 + 0.50 × 75; L + 0.25 + 0.75 × 60.

In considering the use of glasses, many of the youngsters who have small hypermetropic errors or are emmetropic are potential myopes. The parents should be made aware of this probability and of the hereditary nature of the refractive error.

The incorporation of prism for an associated vertical anomaly, for distance only, is not of value in these cases since the absence of the vertical deviation for near may lead to prism-induced symptoms.

The use of dark glasses in bright light for the relief of confusion. In such cases of visual confusion the child closes one eye in bright light because the light seems to stimulate the suppression of

fusion and thus permits divergence (Costenbader, et al.[2]). He rubs one eye frequently, has an attitude of annoyance when the eye diverges and, at times, an actual diplopia when manifest divergence is present. Dark glasses thus add to comfort and protect against divergence.

Near work stimulation. Near work of a detailed nature should be encouraged because of the increased attention which stimulates convergence. This aims at preventing secondary convergence insufficiency.

Orthoptics

In cases of the divergence excess type of comitant exotropia, orthoptics (both preoperative and postoperative) should aim at overcoming suppression, since this is probably the sequel to diplopia at the onset of the neuromuscular anomaly. The suppression is eliminated here by teaching the awareness of diplopia. Let me simply mention (1) the use of the red glass and/or vertical prisms to produce crossed diplopia at 20 feet, at first in the dark, then in the light, (2) physiologic diplopia and framing of objects at distance, and (3) the use of the stereoscope and major amblyoscope for the stimulation of fusion and amplitude at 20 feet. Convergence exercises may be useful when secondary convergence insufficiency is present, but in the pure divergence excess case, I have found the value of orthoptic instrumentation to be limited to overcoming suppression and increasing fusional amplitudes.

Surgery

The ultimate treatment of the divergence excess type of strabismus, whether or not the awareness of diplopia has been learned, is usually surgery. The usual procedure is recession of one or, more usually, both lateral recti. However, if there is normal muscle balance for near and a deviation only for distance, a convergent strabismus for near may result. In such a case with normal muscle balance for near, recession of the lateral rectus muscles must be associated with a smaller *recession* of one or both medial rectus muscles. "Pure" cases of divergence excess are not frequent and most surgical cases fall into the mixed divergence excess-convergence insufficiency group, the surgical treatment of which will be discussed below.

DIVERGENCE EXCESS AND SECONDARY CONVERGENCE INSUFFICIENCY

As in the cases of divergence excess, the treatment of the mixed cases may be considered under the following headings: (a) optical treatment and near work stimulation, (b) orthoptics, and (c) surgical treatment.

Optical Treatment and Near Work Stimulation

The refractive errors should be corrected in the same manner described for divergence excess. Near work stimulation should be encouraged and dark glasses used in bright sunlight.

In youngsters under 5 years of age in whom there is progressive secondary convergence insufficiency, early surgery is definitely indicated and should be done as soon as it is evident that the condition is progressing.

Orthoptics in Patients Over 5 Years of Age

In mixed cases, in addition to the methods described to teach awareness of diplopia, orthoptics should be used to increase fusional amplitudes, eliminate suppression, and improve convergence.

The convergence exercises may include simple convergence exercises such as those done with the finger or pencil, or other more accommodation-stimulat-

ing methods such as bringing small objects up to the nose, prism convergence exercises, use of the stereoscope and slides, the major amblyoscope, and possibly the rotoscope.

Surgical Treatment

The type of surgical correction in these cases depends on one's experience. Burian[1] feels that it is not particularly important whether one does a recession of one muscle or a resection of the other so long as an intelligent approach to the deviation is maintained. Surgery does not change the innervational defect, only the mechanical position of the eye. Costenbader prefers bilateral surgery, resecting the medial recti in cases where there is secondary convergence insufficiency and doing a recession of the lateral recti where there is a pure "divergence excess." I prefer recession and resection on one eye in the mixed cases, largely because it permits better evaluation of the amount of residual correction when both eyes are to be attacked.

The surgery is done on the more frequently deviating eye if the deviation is under 50 prism diopters. If over 50 prism diopters, I prefer to do a 4 or 5 mm. recession of the lateral rectus and an 8 mm. resection of the medial rectus of the more frequently deviating eye and then remeasure after one month and do the remainder on the other eye. In instances of very marked divergence of over 45 arc degrees, one must use a larger recession of the lateral rectus up to 7 mm. In exceptional cases it may be necessary after maximal recessions and resections on both eyes to do a complete tenotomy of one lateral rectus to obtain the desired result. I cover only the operated eye for a period of three days. A child thus awakens from anesthesia without the panic associated with inability to see, as when both eyes are covered. In cases where both lateral rectus muscles are recessed, only one eye is bandaged in the same manner.

It should be kept in mind that the measurement of the deviation in intermittent exotropia is often not the actual total latent deviation present. I have found it important in using the cover test with these cases to do the alternate covering slowly and to be sure that the deviation first be overcorrected with prisms and then brought back to the neutral point. If this is done, one may find that a case which was considered of the divergence excess type actually has as much, or nearly as much, deviation for near as for distance.

Because of this varying ability to overcome the divergent deviation by convergence, the opportunity to remeasure the deviation after one eye has been operated upon is welcome and leads to more satisfactory results.

As a result of an experimental study on nonaccommodative comitant strabismus in adults in 1943, I have used a series of measurements of the amounts of recession and resection to be done for varying degrees of strabismus. In spite of the disappointments and considerable individual variations in results, I have found them so helpful that I continue to use them. I present these figures for your consideration. They are not intended as absolute figures but only as a basis of forming your own guide.

It will be noted that with increasing total amounts of recession and resection, there is an increasingly greater amount of correction per millimeter of surgery. This is particularly true in the deviations of 40 prism diopters and above. This is not the same as saying that the higher the degree of esotropia, the higher is the correction, as held by O'Brien.[3]

INTERMITTENT EXTROPIA (MIXED TYPE)

DEVIATION (PRISM DIOPTERS)	RECESSION OF LATERAL RECTUS (MILLIMETERS)	RESECTION OF MEDIAL RECTUS (MILLIMETERS)
10	4	—
12	2.5	2.5
15	3	3
18	3.5	3.5
20	4	4
22	4	5
24-26	4	6
28-30	4	6.5
32-34	4	7
36-38	4	7.5
40-45	4	8
over 45	4	8 on one, remainder on other except with very high deviation, as discussed

The treatment of intermittent exotropia may be summarized as follows: The optical treatment includes full or overcorrection of myopia, undercorrection of hypermetropia, dark glasses in bright sunlight, and near work stimulation. The orthoptic treatment includes the teaching of awareness of diplopia, correcting suppressions, and improving fusional amplitudes. In mixed cases convergence exercises are added. Surgically, the pure divergence excess type is treated by recession of the lateral recti while the mixed cases are treated with combined recession and resection or by bilateral resection of the medial recti, depending on preference.

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ORTHOPTIC TREATMENT

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THE three previous speakers have given us an excellent picture of the physiology, diagnosis, and clinical management of intermittent exotropia. I shall now attempt to follow through with the orthoptic treatment.

Since in the development of intermittent divergence excess there is first divergence, then diplopia, then suppression, this sequence must be reversed in treatment. In so doing, suppression must be overcome by creating diplopia. The establishment of diplopia may be done by means to be outlined later. Once diplopia is established, fusion training is begun. Next, fusional amplitudes must be increased so that the eyes may hold parallelism more easily.

In intermittent divergence excess a greater amount of suppression exists than is frequently appreciated. The initial step in treatment is to overcome this suppression. To do this, the dominant eye is occluded twenty-four hours a day. The type of occlusion should be total and constant. The elasto-plast occludors are preferable and are worn without too much difficulty. The occlusion might be worn for several weeks to several months, depending upon the depth of suppression, age and cooperation of the patient, and the understanding of the parent. In addition, antisuppression exercises are given both in the office and at home. Specifically, with a red filter over the dominant eye, we like to have the patient do tracing and coloring, string red and white beads and make bead designs, and read red and black type. These are very simple and inexpensive exercises for the patient inasmuch as the instructions are easily understood and the materials are inexpensive and easy to procure.

After we have overcome suppression, intensive orthoptic treatment may be started at home and in the office for stimulating diplopia. If it is physically and economically possible, it is preferable to have the patient in the office two or three times weekly for thirty-minute periods.

To elicit diplopia, treatment may be carried out in the following sequence.

First: Stimulation by use of a dark red glass. This may be done by using a very dark red glass over the dominant eye in a dark room, while the patient fixes a light at 20 feet. Usually this type of case appreciates a crossed diplopia very readily if there is little or no suppression present.

When this is accomplished, the patient is placed in a normally lighted office or room and again is checked for diplopia. When he is able to appreciate diplopia, we are ready for step 2, which is the teaching of what is called "conscious diplopia." Conscious diplopia is the awareness of two images when the eyes are not parallel, and the teaching of it will take much effort and concentration on the part of both patient and technician.

The patient is placed at a distance of

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20 feet from a light. He fixes the light with the dominant eye while a graduated red glass is placed before it. The graduated red glass that I use is a ladder on which is mounted a series of red filters, beginning with a very dark, almost black color, gradually shading out into pink, and finally white.

The patient can appreciate diplopia very easily until he gets into the paler shades. Then we have him concentrate on a small light at 20 feet and, with the hand occluder, cover and uncover the deviating eye until he sees a pink light with the dominant eye and a flashing white light with the deviating eye. This is done until he reaches the white-glass stage and can appreciate diplopia with ease and without aid. When he can appreciate diplopia without using the red glass, we then have him look from one image to the other and note the movement of his eyes. To check on this, a prism of the same amount as his deviation is placed base in over the deviating eye. He may see the two lights merge at once, or he may see the two lights approach and fuse as increasing prism base in is used.

A second method, which may be used to establish conscious diplopia, is the use of a vertical prism which may be held base up or base down over the deviating eye. While the patient is observing the vertically displaced images thus produced, the prism is gradually rotated to the base in position until a crossed diplopia is elicited. It will be necessary to use a prism of a smaller degree than the angle of deviation so that fusion cannot occur.

After conscious diplopia has been firmly established, the treatment becomes much easier for the patient, parent, and technician. The teaching of conscious diplopia is also carried out at home. The parent is asked to observe the technic in the office and is instructed to work on this at least twice a day for fifteen-minute to twenty-minute periods with the patient.

The next step in the sequence of treatment is to teach the patient what is often called "control." By this is meant knowing when the eyes are deviated because two images are seen, the ability voluntarily to reduce them to a single image, and then consciously allowing them to appear as two images again. The patient may be unable consciously to bring two images together at 20 feet, so the point less distant is found where the patient can hold "eyes straight." From here, the distance is gradually increased until he is able to do it easily at 20 feet. When the patient finds this difficult, one method which has been found helpful is to place a light at eye level at a point 20 feet from where the patient is sitting, and to interpose a series of objects, such as pictures, blocks, or books in a straight line three or four feet apart on the floor between the patient and the light. The patient looks at these objects from where he sits, beginning with the one nearest to him and observing each in sequence until he gradually raises his eyes to see one light at 20 feet. This may take many attempts, but it becomes easier since the eyes are in a more convergent position when he is looking down than when he looks straight ahead.

Now the patient is taught to appreciate "physiologic diplopia." I want to say here that physiologic diplopia cannot be elicited if there is any element of suppression present, or if the eyes are deviating. In order to elicit physiologic diplopia, it is necessary for the patient to maintain constant fixation on a distant object. While he is fixating at 20 feet, a pencil or a bar is held vertically 13 inches from his eyes, and he is asked how many pencils he sees. If physiologic diplopia is present he will see two pencils. If he sees one, he is told to close his eyes momentarily and again fixate the distant object. It may be necessary

to repeat this many times until at last he becomes conscious of two pencils. Or, while he is fixating the distant object, one can rapidly cover and uncover either eye repeatedly until the patient is conscious of the double near image.

Now he is taught to fuse with a red glass over the dominant eye. Some difficulty may be experienced in maintaining fusion at 20 feet, but again, we find a nearer point where he fuses more easily. Then the distance is gradually increased until fusion is easily maintained at 20 feet.

While the methods already mentioned are being used, fusion can be stimulated on the major amblyoscope. The instrument is set at zero and a gross second grade target is placed in the machine. At this point, the patient should be able to hold his eyes straight, and with the eyes so placed, fusion is stimulated with macular massage. Gradually the size of the targets is decreased. This may be a little difficult at first, but once the patient gets the "feel" of fusion, he works very hard until he masters it. When he has accomplished this, we start to increase his fusional amplitudes. In doing this, we are increasing the divergence power as well as the convergence power, which may seem like a paradoxical situation. However, it is very necessary inasmuch as a divergence excess has little or no active divergence in the beginning.

The methods which may be used to increase amplitudes are varied. These include the use of the major amblyoscope, stereoscope, red glass over one eye with rotary prism, or prism bar, or with loose prisms base in and base out. All of the procedures make it important to the eyes to continue fusing in spite of the fact that an attempt is being made to throw them out of line.

Again, I would like to emphasize that it is not well to try to improve fusional amplitudes until one is sure that suppression has been overcome and good fusion exists under ideal circumstances.

For home use, the amplitudes may be increased by using a stereoscope with base in and base out cards; also, prism bars may be rented.

The home treatment in these cases is most important, just as important as a music pupil practicing his lesson. There should be much reading, tracing, sewing, weaving, bead stringing and model building. The parents are very cooperative when they can appreciate the progress that is being made by working with the youngsters at home.

We must realize that when we treat divergence excess, we frequently have to treat convergence insufficiency as well. Treatment can be carried out by the same methods already discussed, except that the procedures are reversed. Here the aim is to find the nearest point of fusion and bring it closer to the patient. In divergence excess, we find the farthest point at which the patient can fuse and work towards infinity.

In conclusion, there are three points I would like to stress.

1. Suppression existing in this type of case is much deeper than is often realized, and unless it is eradicated, diplopia cannot be elicited, and fusion cannot be achieved.

2. This type of case demands intensive and often prolonged orthoptic training.

3. Finally, the decision for all of the treatment is in the hands of the ophthalmologist, and frequently surgery is necessary, particularly in larger degrees of deviation. However, much better results can be obtained by correlating properly the orthoptic and the surgical treatment.

INDIVIDUAL CORRECTION OF STRABISMUS

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In trying to reach a conclusion regarding specific treatment and correction for strabismus, I have found that each strabismus patient is an individual and must be treated as such. We do have various classifications of strabismus and certain types of general procedures which may be followed, but there the routine stops. It is simple enough to say we treat accommodatives with glasses and orthoptics; nonaccommodatives with orthoptics and surgery; part accommodative and part nonaccommodative with orthoptics, glasses and surgery; and cases for cosmetic purposes with surgery alone.

However, the various approaches and applications of these corrective measures require individual treatment to bring about the desired correction, so a complex situation develops out of a seemingly simple condition. Strabismus can be treated from two different points of view, either functional or cosmetic. I am certain this group prefers a functional correction for squinters if possible. Otherwise, you would not have gone to all the expense, time and effort to become technicians, and I might add that you would have looked for an easier occupation.

To bring about a functional cure for a squint takes an unlimited amount of patience on the technician's part, a continuous responsibility for the ophthalmologist, an added educational task for the patient and an extra expense for the parents, with complete cooperation by all the persons involved. Unless orthoptics is carried out in a whole-hearted manner, successful results cannot be achieved and neither should they be expected.

It is necessary that training be directed to the individual condition and the problems presented in each case. To break down these conditions and classifications to an individual basis, let us take certain factors and discuss them in detail.

Time probably is one of the largest factors to be considered in squint correction. So much of our work is based on the time element: the time the squint first occurred, the time for orthoptic training to be started, the length of time orthoptics should be given, the time for glasses to be changed and the time for surgery. We work with the time element in planning our treatment for the squints, yet we can actually depend upon these various conditions only as indicators, as individual development governs the methods employed.

With squints, it is necessary to consider time in the abstract only. The amount of time necessary for a correction should be given, and not a given amount of time set for the correction. In my practice, I have ceased to set a time for any definite procedures, but instead I work from indications which arise in the patient's development. This does not imply that an unlimited time is given before definite objective procedures are taken. In fact, an objective lead is necessary throughout the entire

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treatment of an individual case, but not because the patient has been treated for a certain length of time and something active should be done or because surgical procedures should be taken at a definite age regardless of other factors. The individual indicates the time for various objective measures to be taken at any age and stage in treatment, whether they are mechanical or developmental in nature. These indications can be advantageously used in the very young; so much so, that my treatment of squints begins with infants instead of delaying treatment until the child is 2 years of age, as I did in my early years of squint practice. Treatment has been successfully instituted in infants as early as four months after birth.

It would be a definitely progressive step in treating strabismus if the pediatricians and doctors in general would recognize this fact and refer cases of strabismus at the very first sign of a squint rather than waiting until the child is 2 or 3 years of age. In reaching the infant before a set pattern of seeing has been formed, that is, before the neuromuscular apparatus and sensory system have been completed and stabilized, it is possible in a large percentage of cases to guide development into a binocular pattern instead of waiting and allowing it to become a monocular pattern or an abnormal binocular pattern. Until the child has reached the age of 2 to 3 years, the binocular apparatus, though present except for the accommodative-convergence association, is still far from being stable.

It is this instability which allows us the opportunity to direct a corrective course. Occlusion of the fixating eye serves as a means of treatment. The fixation reflex is present very shortly after birth, and because of this it is possible to begin treatment before the visual acuity has fully developed or can be ascertained. The most common type of squint present from birth is a nonaccommodative one with a paresis of one or more muscles. Fixation may be alternating or monocular. The deviation usually is quite marked and there may appear to be a paralysis of the sixth nerve. Often the head is turned instead of using the lateral rectus. This, however, should not be confused with a paralysis. Interesting factors associated with the paresis are the presence of an overaction of the medial recti and inferior obliques. In addition, frequently an alternating sursumduction is found. Even in an alternating strabismus, usually there is a preference for one eye to fixate. Thus, the choice of the eye to occlude is not difficult in the beginning.

In using occlusion in this manner, it should be kept in mind that merely alternating occlusion and achieving fixation is not the goal desired. It is just the opposite. Every effort is made to keep alternating fixation from becoming a set pattern by not permitting either eye to continue fixating long enough for a definite habit to form, either in an alternating or unilateral strabismus. The rapidity of change in fixation from one eye to the other depends upon the age of the patient when occlusion was begun and the severity of the paresis. The younger the patient and the less severe the paresis, the sooner will the fixation be expected to change.

Adler brings out in his writings that the fixation reflex is an excellent stimulus to the muscle movements of the eyes. This is well demonstrated in infants as it will very soon become apparent after occlusion of the fixating eye; the rotations will improve and soon the head will cease to turn unless the

paresis is very severe. Actually, it is not the visual acuity at this age that is of most concern but the patterns of fixation, rotations and fusional development.

FIGS. 1 and 2.—Head tilt and left lateral paresis at 13 and 15 months of age during complete occlusion therapy.

CASE REPORT

Figures 1, 2 and 3 illustrate points of interest in one case treated by complete occlusion therapy. Squint and head tilt had been present since birth. On first examination when the child was 4 months of age, there was a left non-accommodative convergent strabismus of 60 prism diopters with a head tilt and marked paresis of the left lateral rectus. The first two pictures (figs. 1 and 2), taken when the child was 13 and 15 months old, were taken at home, as photographs at this time were not included in the examination at the office. No earlier photographs were available as the parents had purposely not wished pictures of the crossed eyes. When the child was 4 months of age, at the time occlusion was begun, no attempt was made to use the left lateral rectus even when the right eye was covered. The head tilt was twice as marked as shown in the pictures and did not disappear until about 20 months of age. The left lateral rotation

FIG. 3.—Age 4 years, visual acuity normal, head straight at all times, left lateral complete, and parallel alignment of eyes. Complete occlusion only treatment used.

was not complete until the child was nearly 3 years old.

The child is now 4 years old (fig. 3), and the head is straight at all times. Rotations are normal. Versions show an overaction of the inferior obliques. The primary divergence insufficiency present in the beginning has not been apparent during the past year. As a secondary deviation, there is still present an esotropia for near of the convergence excess type. Visual acuity is normal for the age and the refractive error is negligible. Orthoptic training will probably begin during the fifth year.

Prognosis: favorable for single binocular vision. Surgery is not indicated as parallel alignment has been achieved through occlusion therapy. A normal relationship of convergence and accommodation should develop successfully through orthoptic training by eradicating suppression for near.

After a fundus examination has been made and occlusion procedures decided upon, the parents are instructed regarding the use of occlusion. They are taught how to make a choice by observation of the fixating eye and to occlude that eye every day. At first, observing the infant for half an hour a day is sufficient to decide which eye to occlude. As development takes place and the preference for fixation changes, a longer period of observation is required before deciding which eye to occlude. When the preferred fixating eye becomes the deviating eye for the first time, the occlusion is left off for a longer period of time, approximately an hour. If during this time the originally fixating eye, which is now the deviating eye, does not resume preference for fixation, the other eye is occluded, but only for two hours. Again the eyes are observed for an hour and if the originally fixating eye has resumed preference for fixation, the occlusion is returned to that eye.

Should the originally deviating eye still be preferred during this observation period, it is possible that at this time the eyes may make movements toward parallel alignment. During this time occlusion is left off and not resumed until the deviation becomes constant. Gradually it becomes possible for the occlusion to be left off for longer periods of time. As periods of parallel alignment increase, occlusion decreases.

About the third year of the child's life, he is ready to attempt the adjustment of accommodation-convergence association which begins to develop around this age. Convergence may still be excessive and the normal association of accommodation-convergence not possible. If this occurs, occlusion is used over the fixating eye for near vision only, if parallel alignment is maintained for distance. Playing with large toys is encouraged and occlusion is left off at times when the deviation is not present. By the sixth or seventh year the accommodation-convergence association should have become fairly well adjusted, but in some cases stability of single binocular vision is not established until the eighth or ninth year. Orthoptic training greatly aids the development of the binocular pattern during the period from the fifth to the eighth year of age by exercises directed toward the convergence excess, increasing fusional range, the development of hand-eye coordination, and single binocular reading.

Ten years ago, squints in children under one year of age were rarely seen in our office, as we were of the opinion that it was soon enough to begin corrective proceedings when the child had reached the age of 2 years. However, it became evident to the late Dr. Grady Clay and myself that we were not meeting the needs of the squinters under 2 years of age. Neither were we taking advantage of the instability present in the very

young that would lend itself to corrective guidance. Instead, we had been waiting for stability to develop so that we would have a set condition to treat. With this in mind, we began treatment of a few infants. The successful response of these cases encouraged us to set the age for squint treatment at the time of the first appearance of the squint rather than waiting until the child was 2 years of age.

It is not always possible to achieve parallel alignment by occlusion in infancy and secure binocular single vision with orthoptic training. However, the increasing successful results that have been obtained justify attempts. Should the desired state not be reached, occlusion still is of value in aiding visual development, improving rotations and preventing abnormal patterns from forming, as well as lessening the deviation.

When deciding upon surgical procedures for the squinter, it is taken for granted that every ophthalmologist desires to achieve the best result possible. He chooses the type of operation he thinks will meet the need of the individual squinter to bring the eyes into parallel alignment. Some of you are better acquainted with squint surgery than others, but all of you see results from surgery and have a record of the type of operation and the amount performed.

Surgical procedures are estimated in millimeters or degrees of arc, but the number of millimeters is not as important in surgery as the fact that the muscle was moved, a point which Dr. Lancaster brought out so clearly. However, surgical information is necessary in relation to orthoptic training postoperatively, particularly if the patient was not seen preoperatively. An incomplete rotation of the muscle involved from surgery will present a mechanical restriction that orthoptic training cannot overcome.

The possible functional cure of any type of squint depends upon the procedures and treatment taken by the ophthalmologist, whether they are surgical, refractive, or other prescribed treatment. No matter how good the technician is and how well the patient responds to orthoptic procedures, if the ophthalmologist does not understand child development and work with these developmental levels, a successful functional result cannot be obtained.

In considering surgery, there are several factors involved. This discussion excludes cases of paralysis and those with pathologic findings. From a surgical aspect, we are concerned with the nonaccommodatives and the part accommodatives-part nonaccommodatives. These cases usually have had a very limited binocular experience or not any. If all our squint cases fell into the group where the deviation did not occur until the ages of three or four years, procedures would be greatly simplified, as usually a binocular background has been present prior to this time.

As a large percentage of the nonaccommodative squints are present from birth, corrective procedures are necessarily more involved. The severity of the complications depends upon the individual case and the age when the patient was first examined. As previously stated, if treatment could be instituted in infancy, the normal reflex development could be used to advantage. However, many squints are not seen for examination before this period is over, and mechanical correction is required. Quite a large number of these nonaccommodative squints are alternators, and fortunately, fixation is good in each eye and the visual acuity has developed normally from birth. Frequently, the deviation is large and the fusional range small. It would seem a simple solution to operate, obtain parallel alignment,

and allow the patient the opportunity to fuse spontaneously. The patient then should develop single binocular vision, have a normal use of the eyes, and be cured.

This does work out satisfactorily in some cases with a past binocular experience. However, in the nonaccommodative group where the squint has been present from birth and no binocular pattern formed, the opposite occurs. After surgery, instead of developing binocular vision, the patient continues his monocular pattern of seeing. The chief reason for this is suppression. This habit was learned when the deviation was too great to allow fusion, and any attempt at bifoveal fixation only resulted in confusion and an undesirable and therefore unaccepted diplopia.

If orthoptics had no other value than serving the purpose of combating suppression, this would be of sufficient benefit to warrant the use of it. Eradicating suppression lies in the orthoptic field and through the efforts of the technicians. The ophthalmologist cannot correct this error by a mechanical means.

The correction of strabismus does depend upon the ophthalmologist's treatment of the case, but in many instances the ophthalmologist must rely on the technician to bring about successful results of his work, from a cosmetic point of view as well as a functional one.

Let it be understood that it is not always poor work on the part of the ophthalmologist but rather the individual's lack of adaptability to the situation. This is another reason orthoptics is desirable and often necessary as it is the only means of teaching the patient how to correct bad visual habits. Through preoperative training the patient learns to accept diplopia, develop binocular vision, and form correct habits of seeing, even though of an artificial nature for a time. In learning to accept diplopia and reject suppression through the guidance of orthoptic training, the patient has overcome one of the greatest problems in squint correction. When the squinter can physically and psychologically accept diplopia, the highest level of orthoptic training has been reached. The remaining corrective measures are almost automatic. With the establishment of binocular vision, either the fusional range allows parallel alignment of the eyes, or they are aligned mechanically.

To achieve single binocular vision is another problem for the individual squinter and the technician. The squinter from birth has not had the experience of the convergence-accommodation association and, unless taught how to make this final adaptation to binocular seeing, becomes confused and falls back to the laws of nature for protection by suppressing for near work. The squinter may find the binocular world quite satisfactory for distance and not mind having a phoria for distance and a tropia for near. However, this should not be necessary, as the progress made in present-day orthoptics offers the squinter an opportunity to learn how to form normal habits of seeing rather than resort to abnormal ones.

The suppression versus diplopia problem is met again in developing single binocular vision for near work, and this may be more difficult than the correction of the original suppression. The patient encounters a psychological problem as well as a visual problem. An undesirable blurred condition must be temporarily accepted willingly and wholehearted cooperation given if single binocular vision is achieved for near work. Suppression is eradicated by ac-

cepting diplopia; diplopia is eliminated by developing sufficient fusional range; blurred images are cleared by learning a normal relationship of accommodation and convergence.

Orthoptics lends itself to individual application in various ways. By one means or another with which you as technicians are familiar, the patient is taught not to suppress but to accept bifoveal fixation. With this accomplishment, surgical procedures are often reduced. We speak of developing fusion before surgery if possible, when actually it is the eradication of suppression that determines functional results.

In the child under three years of age with nonaccommodative squint, even with the best possible surgical results, there is too great an instability present and too great a lack of a bifoveal fixation habit for single binocular vision to develop spontaneously. The eyes may be correctly aligned surgically and fusion may develop for casual seeing, but suppression usually occurs for near. Often an excellent cosmetic result is achieved surgically but suppression is still present, and a monocular pattern of seeing continues. It is my opinion that if children who squint from birth are operated upon before individual indications are present, there remains a residual deviation, suppression continues, and other abnormal patterns of seeing may develop. It should work out that the earlier surgery is performed the better the chance for binocular habits to form through the normal reflex development of the eyes.

However, in the results seen from early surgery, it has been my experience to find in the best results an esophoria for distance and an esotropia for near. More often, there was complete suppression for distance and near.

Other conditions found postoperatively were overcorrection, amblyopia, abnormal retinal correspondence and undercorrection. Surgery on these cases had been done when the child was from one and a half to five years of age. Some of these patients were my own and others were seen by my colleagues in various sections of the country. A few of them had occasional orthoptic observation and occlusion at times, others none at all. Findings on these cases have been taken from six months to eight years postoperatively. In one instance, surgery was continued at intervals over a period of eight years, and the deviation still remained.

The patient, now 15 years of age, whose case is illustrated in figure 4, gave a history of four surgical procedures. The position of the eyes with and without correction is shown in upper two parts of figure 4. The residual deviation from this alternating, part accommodative and part nonaccommodative convergent strabismus was 30 prism diopters for near and 20 prism diopters for distance. After one week of orthoptic training, diplopia was elicited spontaneously (fig. 4, third part). Suppression was eradicated and fusion became spontaneous after three weeks of orthoptic training (fig. 4, last part). Binocular vision was present for casual seeing in four months. Single binocular vision for near without correction developed in a year and a half. Probably orthoptic exercises will be continued for a year longer until this new habit of seeing is fixed. Figure 5 shows the absence of a previous marked overaction of the inferior obliques after binocular development. An abnormal retinal correspondence was not present in this case.

In nonaccommodative squints, if the deviation is too large for preoperative

FIG. 4—Two upper parts show residual deviation after four surgical procedures over a period of 8 years. Third part shows suppression eradicated after one week of orthoptic training at 15 years of age. Last part. Single binocular vision.

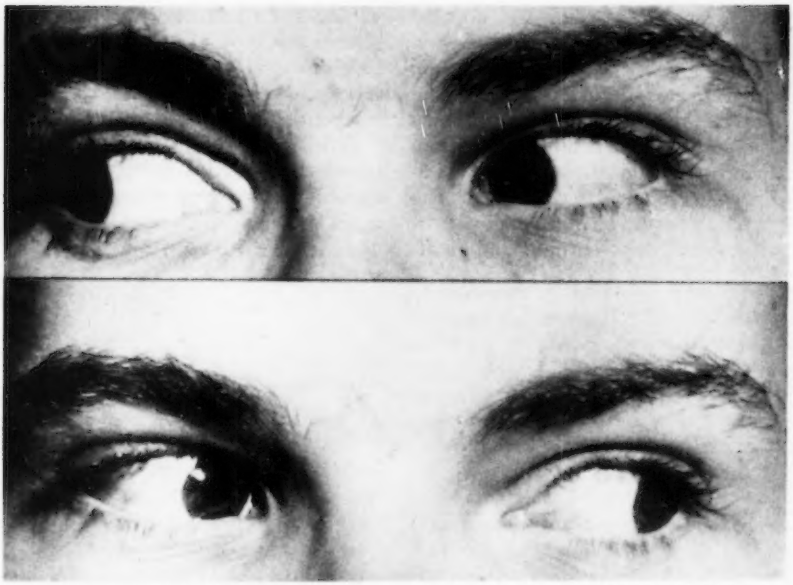

FIG. 5.—Absence of previous marked overaction of inferior obliques after binocular development.

orthoptics and the patient too old for infant occlusion therapy, surgery is indicated before diplopia becomes spontaneous. However, before the second operation, it is desirable to use occlusion and preoperative orthoptics.

When the patient can spontaneously accept diplopia but the fusional range is insufficient to overcome diplopia, surgery is indicated. The patient by this time should have reached the age where postoperative orthoptics could be used to an advantage in developing single binocular habits applicable to daily life. Surgery before this time may give a good cosmetic result, but it may also encourage amblyopia, suppression and/or abnormal retinal correspondence if the patient does not accept diplopia and have the ability and stability for overcoming it through fusional development.

Whether the squinter and technician consciously and objectively work toward eliciting diplopia or not, further progressive work cannot be accomplished until diplopia is accepted. That is, the quicker the patient appreciates diplopia, the sooner it can be corrected.

CONCLUSIONS

When the results of treatment of nonaccommodative squints by occlusion therapy and preoperative orthoptics are analyzed, it is found that the number of successful cases far surpasses that of cases in which surgery and glasses alone were used. Where occlusion therapy did not bring about a correction in itself, it did prevent the formation of a definite

pattern of suppression as well as other abnormal habits of seeing and allowed an individual treatment of the case. Ophthalmologists who use orthoptic procedures can go further in planning an individual correction of strabismus and expecting a functional cure than when surgery or glasses or both have to be depended upon for correction. The opportunity should be given each patient for individual consideration and treatment of various problems involved. Whereas certain developmental levels govern the type of treatment that can be given at a certain age, the age in itself should not be the deciding factor in corrective procedures.

Finally, the most important thing in the treatment of squint is that treatment should be started as soon as the diagnosis is made, which may be at the age of four months.

STRABISMUS CASES OVER A PERIOD OF YEARS

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THE dismissal of a patient from active orthoptic treatment is a serious step and follows much deliberation and, in some instances, concern on the part of the technician. Each of us, I am sure, feels responsible for his charge not only today, but tomorrow and in the years to come. Our aim is to obtain the best binocular skills of which the patient is capable. Sometimes we succeed, and other times we fail. Just why this is true is still a matter of conjecture and needs more study and research. We must often remind ourselves that we are dealing with human beings, not blocks of wood, and what will do for Johnny will not do for Susie. We cannot develop something that is not there nor give to the patient what he will not strive to obtain. "Orthoptics," says Julia Lancaster, "is not a treatment done to the patient; it is an opportunity offered to the patient. It is subject to the limitations inherent in all opportunities, they may be accepted or rejected by the patient."

Whether Johnny is dismissed, therefore, as a cured patient, or partially cured, or with a purely cosmetic result, the chief thought in the back of our minds is the question of what he will show one year from now, five years from now, twenty years from now. Will his old deviation return? Will he again show anomalous correspondence? Will he lose visual acuity in one eye? Will a surgical overcorrection cause trouble in later years? These and many more questions rise up to confront us as we bid Johnny goodbye and tell him to be a good boy and be sure to do his home exercises.

For this reason I have taken some 40-odd patients at random, called them in and checked symptoms, deviations, and fusional status. These patients have not had active orthoptic treatment for a period of one to ten years. They were not selected but were taken as they responded and include a few who came up to Mary Kramer's standards of a cure, some who were partially cured, some who had had surgery only, and some who did not continue treatment until satisfactory results were obtained. Included are patients with esotropia or exotropia, and a few with postoperative overcorrections. These cases had been under the care of several technicians, which in a certain sense was a handicap. Each technician has her own way of recording her findings, and her own tests which she finds useful, and some of these methods were unfamiliar to me. Consequently I checked only with the cover test, major amblyoscope and Worth four-dot test, and measured visual acuity.

The work done is elementary, mainly for my own interest, and not to prove any points or bring out any startling facts. I realize 40-odd cases are not enough for any statistical analysis, but this is a step toward the goal, and I hope more of us will do some intensive research in this field. I found it fascinating and am sure many of you will, too.

I shall take up the 39 esotropia cases first. My greatest concern is anomalous correspondence, which Dr. Burian defines in these words:

> Anomalous correspondence is said to exist in a patient when elements of the two retinas

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which are ordinarily disparate—such as the fovea of one eye and an eccentric element of the other eye—prove to have a common visual direction.

Dr. Lancaster says:

Retinal correspondence is not an anatomic peculiarity innate and unchangeable. In squint, anomalous correspondence frequently develops. In this condition a different point of the retina of the squinting eye acquires a more or less perfect correspondence with a point of the non-squinting eye. This is secondary correspondence or anomalous correspondence.

In discussing anomalous correspondence with doctors and fellow technicians it has become apparent to me that there is a difference of opinion in our criteria for it. In order to prevent any misunderstanding I have divided these cases into two groups. Those who show a definite subjective angle less than the objective angle on the major amblyoscope and have crossed diplopia at the objective angle, I have classified as having anomalous correspondence. Those who show a crossing of images rather than a subjective angle but have crossed diplopia at the objective angle, I have listed as cases of retinal non-correspondence or as cases with a tendency toward anomalous correspondence. I shall consider each group separately regarding findings at the beginning of treatment, when dismissed from treatment, and at the 1951 recheck visit, and then shall attempt to correlate them as a whole.

In 10 cases a definite anomalous correspondence was elicited, 80 per cent unharmonious in nature—the angle of anomaly less than the angle of squint. The cover test measurements varied from 10 to 40 prism diopters base out and the acuity was nearly equal in both eyes with the exception of four who had 20/50 or 20/100. All but 3 patients were given intensive orthoptic treatment which varied in duration. Upon dismissal from treatment, 6 had normal correspondence and good fusion with varying ranges of amplitude and degrees of stereopsis on the major amblyoscope. On the whole, the ability to converge was good but divergence was poor. The visual acuity was equal or with but one line difference in all but 1 case, and 80 per cent had one or more operations. None of them, I am afraid, came up to Mary Kramer's standards of a cure. (See page 37.) Six of the 10 did have a phoria with glasses, homonymous diplopia to fusion on the Worth four-dot test, and varying ability on accessory instruments. Without correction, they still had intermittent or constant tropias with one exception. One still had a tropia with good fusion and convergence but an instability for unlike targets on the major amblyoscope.

On the 1951 recheck of the 3 who had surgery only, with no orthoptics, 1 continued to show intermittent exotropia, a good near point, and equal acuity in each eye. The other 2 still had constant exotropia with diplopia and poor acuity in one eye. I had no chance to test them for anomalous correspondence. All 3 complained of headaches.

Of the 7 who had intensive orthoptic training, 2 reverted to constant tropia with the cover test measurement and acuity the same as before orthoptics. One again showed anomalous correspondence; the other, who came closest to the standards for a cure, retained normal correspondence. Upon dismissal these patients had shown slightly lower acuity in one eye and suppression on the Worth four-dot test, which may account for the return to a tropia.

The one patient with tropia varied from an esotropia to an exotropia but still had equal acuity and normal correspondence on the major amblyoscope, with less ability to converge.

The rest still had phorias or intermittent tropias, with good acuity in each eye, fusion with amplitude, and varying

degrees of stereopsis. None complained of discomfort and all were satisfied with their ability to use their eyes.

Of the two patients with postoperative overcorrections, one had esophoria to exophoria with and without correction depending upon the amount of accommodation exerted. A slight increase in deviation was noted in the other from a 7X at distance and 2X′ at near in 1948 to an intermittent 14X(T) at distance and 8X′ at near in September 1951. The mother had noted an occasional turning out of the eye but no other complaints. His convergence on the major amblyoscope and with prism base out remained good, but his stereopsis was only fair.

In this group, the age of onset was 2 to 3 years in 90 per cent of the cases, which would seem to bear out Dr. Burian's statement:

> It is a prerequisite that the patient have a certain amount of binocular cooperation prior to the onset of strabismus, otherwise he cannot develop an anomalous correspondence.

The patients with retinal noncorrespondence showed tendencies toward anomalous correspondence, but the major amblyoscope brought out a crossing of images or alternate suppression rather than a definite subjective angle. All had crossed diplopia at the objective angle and 18 fell into this category. It is of interest to note that the deviations were higher in this group, ranging from 30 to 95 prism diopters base out without correction, with the majority around 50 ET. The acuity was equal or nearly so by the time orthoptic treatment was instituted with one exception. This patient was uncooperative and did not respond too well to orthoptic training. All but one had orthoptic treatment of varying duration and 15 had one or more operations.

After orthoptic training 6 were dismissed for one reason or another still with constant tropias; 2 still had tendencies toward anomalous correspondence and low acuity in one eye. Ten retained either intermittent tropias or phorias, with and without correction, 5 of which fulfilled, or nearly so, Mary Kramer's standards for a cure. These are:

1. Normal or nearly normal visual acuity in each eye with both eyes straight for distance and near without correction.
2. The cover test shows phoria instead of tropia while the patient is accommodating for both distance and near without correction.
3. Fusion for near and far without correction on the Worth four-dot test.
4. Maintenance of the orthophoric position with clear vision on the Remy separator and diploscope without correction.
5. Ability to read and appreciate physiologic diplopia without correction.
6. Ability to keep eyes straight without correction at all times, under all conditions of fatigue, illness or nervous upset.

She goes on to say, "It is obvious that a cure cannot be obtained in all cases of strabismus," which made me feel better about those who did not come up to the standards of a cure.

Fifteen of the cases had normal correspondence with amplitude on the major amblyoscope and stereopsis varying from none to 100 per cent. The acuity was equal and diplopia to fusion was noted on the Worth four-dot test.

On the 1951 recheck, one case which had been converted to a phoria, reverted to a constant tropia. The patient showed 5E and 7E on the cover test, coinciding of angles at 4E, convergence to 36 prism diopters base out and divergence to 2 prism diopters base in. Her acuity was 20/40 and 20/20, and she suppressed the right eye on the Worth four-dot test. The treatments were discontinued by decision of the parents, and the lower acuity and suppression were more than likely contributing factors to the return of the tropia. In 1951 the patient had a constant esotropia of 28 and 36, 20/30

and 20/20, and no fusion on the major amblyoscope. Her original deviation was 52 ET and 56 ET. The parents were unwilling to continue in 1949 but will do so now.

Of the 6 who had tropias at the time exercises were discontinued, 4 had equal acuity in each eye and 3 had normal correspondence on the major amblyoscope. There was no appreciable change in the amount of deviation, but one had an intermittent exotropia at distance with exophoria at near, another complained of diplopia, and one again had a retinal noncorrespondence.

The deviation remained the same or decreased in all but one patient among those dismissed with intermittent tropia or phoria, acuity equal, and no symptoms.

The one patient who had only surgery and no orthoptics had an intermittent esotropia in 1951 with equal acuity in both eyes and no complaints.

In the normal correspondence group of 11 patients, the deviation ranged from 10 to 60 prism diopters base out, the acuity was about equal in both eyes by the time training was begun, and all had fusion with amplitude on the major amblyoscope with varying degrees of stereopsis. Over 50 per cent showed suppression on the Worth four-dot test. Five had one or more operations.

After intensive treatment, 3 patients still had constant esotropia, fusion with some amplitude on the troposcope, good acuity and fusion to diplopia on the Worth four-dot test. In 1951 they had a greater tendency toward binocular vision than before, becoming phorias to intermittent tropias with about the same or less deviation.

Three cases were partial cures, two coming up to the standards of a cure with correction and one having an intermittent tropia with accommodation. In 1951 two remained the same and the one with phoria had developed a constant alternating esotropia with an increase in his left hypertropia which may have been the reason for the return to a tropia. All other findings were the same.

Five came up to Mary Kramer's standards of a cure and remained the same or improved in 1951.

In reviewing the esotropia cases I would like to repeat that there are not enough cases covered in this paper for any statistical purposes yet certain facts do stand out which might be of interest. Those patients who were dismissed still having anomalous correspondence remained the same in 1951. Of the four surgical patients that had no orthoptics, two still had constant tropias with low acuity in one eye and complaints of headaches and diplopia. Two had developed intermittent tropia with good acuity in each eye and no symptoms.

Of the 10 who still had constant tropias on dismissal, six had normal correspondence in 1951 and four had phorias or intermittent tropias. The acuity was equal in each eye in eight patients. One had reverted to an anomalous correspondence and one complained of diplopia.

Of the 25 who had intermittent tropias or phorias upon dismissal from treatment, four reverted to a constant esotropia, but the remaining 21 still had good single binocular vision or binocular vision at times in 1951.

It is encouraging to note that of these patients, four did have more binocular ability in 1951 than they did when dismissed and that there is little loss of acuity or increase in deviation over a period of years.

I shall consider only briefly the ten patients with exotropia. Three had convergence insufficiency, one had divergence excess, and six had a combination of the two. The deviation varied from an exophoria of 10 D. to an exotropia of 54 D. All responded to orthoptic

training to a certain degree, developing fusion with good convergence ability with and without instrumentation. They had exophoria at near and exophoria to intermittent exotropia at distance. Three had surgical help and two more were advised to have it, but the parents were satisfied as long as the eye deviated only occasionally. In 1951 all but one retained their convergence ability, the deviation remained about the same in all cases, and only one complained of symptoms. She had had 54 XT at distance and near, had two operations, and her convergence ability was slow to improve.

It became apparent to me as I reviewed these case histories that there are many contributing factors to the cause of orthoptic failures and that some patients with phoria again develop tropia often with anomalous correspondence. No one weakness stands out, however, at which we can point our finger and say, "This is the reason." Lower acuity in one eye, suppression on the Worth four-dot test, unstable simultaneous macular perception (in spite of good fusion with amplitude) seem to be warning signals but they do not hold true in every case. It all seems to come back to the individual himself. Johnny is the deciding factor in the end.

In looking over the final results I had a feeling of satisfaction—satisfaction in knowing that while we do not obtain 100 per cent cures and some do revert to a tropia or anomalous correspondence, still the majority benefit by the treatment and hold what they have gained. We cannot perform miracles. We can give to the patient only what he is capable of performing, but we can continue to do our best in the knowledge that on the whole what we are striving for is really worth while.

THE SUBJECTIVE MEASUREMENT OF THE NEAR POINT OF CONVERGENCE AND ITS SIGNIFICANCE IN THE DIAGNOSIS OF CONVERGENCE INSUFFICIENCY

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CONVERGENCE is a fusional movement brought about by disparate stimulation of the two retinas, but convergence does not come about through disparate stimulation alone. It is the only disjunctive movement that is also under the control of the will.

In the various routine tests for convergence the voluntary and fusional convergence come into play in different degrees. In determining the near point of convergence, we measure largely the patient's ability to converge voluntarily; in determining his fusional amplitudes on a major amblyoscope, we measure his ability to respond to disparate stimulations.

When an object, e.g., a light, is placed in front of a person, he will voluntarily converge his eyes to fixate it binocularly, and as the light is brought closer, he voluntarily increases his convergence with more or less of an effort. The nearest point to which a patient should be able to converge both eyes, the normal near point of convergence, varies according to different authors from 60 to 100 mm.

The measurement thus obtained tells us that the patient can converge so many millimeters, but it may be valid only for the particular condition of the test in which he may have made a special effort. Is the patient also able to maintain in everyday life this ability to converge voluntarily? Is his voluntary convergence active enough to help him in the use of his eyes in prolonged close work?

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In the ordinary use of his eyes, fusional convergence is of great assistance to him. Ordinarily voluntary convergence and fusional convergence go hand in hand. We are accustomed to find in patients with orthophoria for distance and exophoria for near a remote near point of convergence if the fusional amplitudes are poor, and good near point of convergence if the fusional amplitudes are satisfactory. But this is by no means always found to be so. In such patients, one often finds poor amplitudes and a good near point or, vice versa, good amplitudes and a poor near point. This discrepancy can be explained by the difference in the stimulus situation between the near point test and the test for fusional amplitudes.

How can one take the near point of convergence in such a way as to minimize the role of voluntary convergence, make it correlate better with the fusional amplitudes, and allow one to evaluate the patient's voluntary convergence by comparing the result with the regular near point test? A chance observation suggests the answers to these questions.

A patient, complaining of symptoms not relieved by refractive correction, had a small exophoria for distance and 20$^{\Delta}$ of exophoria for near with poor fusional amplitudes, but a good near point of convergence measured in the routine way. Accidentally, a red filter was also used in measuring the near point of convergence and a considerable discrepancy was found between the regular near point and this red glass near point test. The red glass near point was

quite remote and agreed very well with the amplitudes that were found. Upon treating this patient with red glass near point exercises it was noted that as the red glass near point improved so did his fusional amplitudes. Finally both the regular (objective) and the red glass (subjective) near points coincided, the fusional amplitudes were very good, and the patient was more or less free of symptoms.

Following this experience I have used the red glass (subjective) near point test routinely in a large number of patients and it has helped in many ways, although it has also raised many questions, the answers to which have not as yet been found.

The measuring of the subjective convergence near point is not new; there are instruments, such as Livingston's binocular gauge, which are designed to measure both the objective and subjective near points. Wherever this is done, the subjective near point is determined without colored differentiation of the fields of vision. May I also add that the red glass near point exercises are by no means new to the orthoptic technicians; we assign them for homework in many cases, but the point I wish to make clear is that I do not believe that many of us use them for diagnostic purposes.

The subjective near point of convergence is taken in the same way as the objective near point except that the patient is asked to hold up a red glass in front of one eye. The patient is shown the difference between the white light and the red light and then asked whether there is a "pink light" or "mixed light." The light is held at a distance where it appears "pink" or "mixed," a ruler is held near the lower margin of the orbit of one eye and the fixation light is brought slowly toward the eyes. The patient is asked to tell the examiner just as soon as binocular vision is lost and diplopia results.

This simple test gave us a direct appreciation of the patient's convergence and excluded, in part, voluntary convergence, which was important. I shall attempt to list some of the advantages of the red glass near point test.

Patients with good or fair amplitudes and a good objective near point of convergence sometimes have a poor subjective near point. If the difference between objective and subjective near point is large, this often means trouble for the patient.

For example, a man of 45 came in to have his glasses changed as he was having a great deal of trouble doing close work. This condition had persisted for a number of years. He was given a prescription for new glasses which gave him some relief. On examination we found orthophoria for distance and 15$^{\Delta}$ exophoria with 2$^{\Delta}$ L.H. for near in the prism and cover test with and without glasses. His fusional amplitudes were 4$^{\Delta}$ of divergence and 25$^{\Delta}$ of convergence for distance and 20$^{\Delta}$ of divergence and 40$^{\Delta}$ of convergence for near. His objective near point of convergence was at 65 mm. but his subjective near point was at 140 mm.

In cases in which both the objective and subjective near point are good but the amplitudes are only fair, the prognosis is good. The fusional amplitudes of these patients improved quite rapidly. Thus, T. C., aged 25 years, complained of headaches when she attempted to use her eyes for close work. In the prism and cover test she had orthophoria for distance and 25$^{\Delta}$ exophoria for near. Her fusional amplitudes were 7$^{\Delta}$ of divergence and 25$^{\Delta}$ of convergence. The objective near point was at 50 mm. and the subjective near point at 60 mm. In two or three visits her amplitudes had improved considerably and her symptoms were gone.

In the course of treatment, the recording of both the objective and sub-

jective (red glass) near point each time the patient is seen gives us another important factor. If the subjective near point is remote and the objective near point is good, and if the subjective near point does not improve very rapidly, neither do the amplitudes. An example of this was a 17 year old student nurse who had a severe case of convergence insufficiency. Her prism and cover test for distance revealed orthophoria and 25Δ exophoria for near. Her objective near point was at 220 mm.; with the red glass, her near point of convergence was at 430 mm. Her convergence for distance was 4Δ and for near, 5Δ. The patient was given red glass near point exercises to do at home and when she returned, her objective near point was at 40 mm. and her red glass near point had improved slightly (310 mm.). As might be expected, there was little improvement in her amplitude: 11Δ of convergence with a great deal of effort. After four visits, her objective near point was at 30 mm. and subjective near point was 200 mm. The patient returned three weeks later having worked on nothing but red glass near point exercises, and at that time her objective near point was at 30 mm. and her subjective near point 30 mm. Her fusional amplitudes now showed considerable improvement, amounting to 90Δ of convergence. The patient felt better and she was able to read longer without too much discomfort.

In conclusion, I should like to sum up the reasons why I believe the subjective red glass test for the near point of convergence is of value in the group which we call cases of convergence insufficiency:

1. With the red glass near point test, less voluntary convergence comes into play and there is a better correlation between fusional amplitudes and near point of convergence.

2. This test helps to determine the prognosis of cases where the patient shows good objective and subjective near points but poor amplitudes.

3. The test helps the orthoptic technician to learn what progress is being made since the objective near point improves, in general, more rapidly and the red glass near point test is, on the whole, a more sensitive test.

4. When there is a large discrepancy between objective and subjective near points, this usually indicates trouble for the patient.

HOME EXERCISES

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AFTER a review of the literature which included articles by such authorities as Miss Stark,[5] Miss Healy,[2] Miss Walraven,[6] Miss Roth,[4] and Miss Eyles[1] concerning home treatment for heterophoria and strabismus, I quickly decided that I had nothing new and startling to present. Thus, this is a review of what my associates and I have at our disposal and what we consider and use in orthoptic home training.

Home exercises play a vital part in the treatment of strabismus and heterophoria. As Miss Walraven mentioned in her paper, "The Parents' Role in Orthoptic Training," "...orthoptic training of squint would be greatly simplified if exercises at home could be omitted." We know, though, that if treatment is to be successful, home exercises are usually necessary. Often visits can be made to the office only once or twice a week, and this is but a small part of the time that is needed to stimulate binocular vision. It should be emphasized in talking to the parents that home training saves them time and money but that it should not be taken lightly on this account.

It is imperative to choose the correct time to begin training in cases of strabismus. We must be sure that the correspondence is normal, that there is fusion with some amplitude, and that it is practical to do work at home.

The cooperation of the patient and parent is extremely important. To obtain this cooperation we must be sure that the exercises are clearly understood. Without a clear understanding of what is to be done, it often is just as well or better to omit the exercises, for if they are not done correctly, they will hamper rather than help the condition. It is advisable to demonstrate the exercises thoroughly and it is often wise to write the instructions. An example of the necessity of not only oral but also written instructions occurred in a case in which occlusion was being used for amblyopia ex anopsia. After several weeks the parent was found to be occluding the amblyopic eye.

It is advisable to suggest a time for home exercises that will fit into the child's daily schedule. The time to be spent each day on exercises depends on the age and attention span of the patient. Often it is better to work a short time at different intervals than to persist for one long period. As Dr. Prangen emphasizes, "They are done best when the child is not cross, tired, or hungry." Although we want children to enjoy doing these exercises at home, we must impress upon them that it is work done for the improvement of their eyes. This will aid in the long run when the novelty has worn off and it still is necessary to continue. We must be careful not to prescribe tasks that are too difficult for the patient; interest quickly disappears if the tasks are either too simple or too difficult. The choice of stimuli should depend on what is interesting to the child, whether it be cowboys and Indians or dolls and tea parties.

Frequent checks by the orthoptic technician encourage the patient and aid in evaluating the progress being made. It is helpful to give patients who cannot be seen frequently a report card on

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which to note the work they have done. This is often an excellent stimulus for children to do their work. All these things tend to build a close association between the technician and patient or parent and this will further the understanding of orthoptics and its part in the correction of heterophoria and heterotropia. We need to stress the importance of time and patience constantly. Often parents feel that all will be well in a few weeks. Although we do not wish to discourage them, we must avoid confusion in regard to our treatment.

One of the first considerations in treatment of a young patient is to measure visual acuity. I find it helpful for the parent to take an *E* home and play a game with the child. Thus the child becomes familiar with it and, on the next visit, it is usually easy to measure visual acuity with the Illiterate E Chart—both for distant and near vision. The same is true with the picture charts used for very young patients.

When we are occluding because of amblyopia, we must stimulate in the child a desire to see better. Many monocular exercises use bright colors and are interesting. These include coloring, fitting or tracing, puzzles, cutting out dolls, building blocks and sewing picture cards. If the child is permitted to do those activities which he enjoys most, such as blackboard work, reading comic books, or going to movies, he will be happy while stimulating the amblyopic eye for better vision. Dr. L. W. Oaks[3] in his paper on squint amblyopia suggested that active treatment such as embroidery, wood carving, leather work, and clay modeling would furnish a creative aspect to stimulate interest. The View Master with the new light attachment is intriguing with its variety of pictures. Often parents will have some excellent methods of stimulating vision in the amblyopic eye, such as playing games while riding in the car.

The next obstacle to overcome is suppression. In many cases of suppression it is advisable to partially occlude the dominant eye by clear nail polish or scotch tape on the lens. The amount applied will depend on the blurring necessary to reduce the acuity of the better eye below that of the suppressing eye. The red lens or red occluder is especially useful when there is considerable macular suppression. With the use of the red lens over the fixing eye, the red in the material observed is absorbed. This is done when using red and black blocks, red and black typed stories or books, bingo games, and puzzles. For older children sewing and knitting with red thread or red knitting needles are good. A trip through the five and ten cent store will often aid one in finding new games and material to use for these patients.

The cheiroscope also is used for anti-suppression exercise and is good training for eye and hand coordination. In cases of strabismus, prisms must be placed over the lenses when the cheiroscope is used in order to have fusion. Exercises for physiologic diplopia can be done for distant and near vision.

The length of time this treatment for suppression should be continued is highly variable, depending on the cooperation of the patient, the type of suppression present, and the progress being made.

While a patient is being helped to overcome suppression, constant effort should be exerted to make him aware of diplopia. Here, too, the red lens is handy, as are the red and green glasses. When the awareness of diplopia is established, the next step in training is toward development of fusion. The Worth-Black amblyoscope is useful, for it can be adjusted to the angle of deviation where the pictures are super-

imposed. Divergence and convergence can be practiced from that angle in order to build the fusional amplitude. Use of the small amblyoscope at home also will facilitate work in the office.

Recession exercises are among the first things to begin when fusion is obtained. The patient uses a red glass over the nondominant eye and fixes on a light in the distance. If a deviation is manifested, he should see two lights; if his eyes are straight and he is fusing, he should see one light of a pinkish color. When the patient notes diplopia, he should walk toward the light until it is fused and then back away while maintaining fusion. Young children should be supervised to be sure they are not suppressing one eye. This exercise can be continued until true fusion is maintained at all distances. Children enjoy this game because they can devise methods of doing it and they can measure their progress easily.

Some technics which we use for home training are specifically for improving divergence or dissociating accommodation and convergence while others are mainly for stimulating convergence. First I will mention some used in cases of accommodative convergent strabismus. Various types of visual acuity charts may be used for dissociation training. It is important with these that the child be carefully supervised while doing clearing exercises, both at 20 feet (609.60 cm.) and at 13 inches (33.02 cm.). The Remy separator is useful, for accommodation is stimulated while convergence is relaxed. The diploscope also is fine for this dissociation work. Bar reading with physiologic diplopia is also advised. In cases of strabismus, exercises with prisms are best given in postoperative cases in which a small residual deviation exists and fusion has developed before an operation was performed. The strength of the prism would be that which would bring fusion of the two images.

In cases of esophoria, exercises may be tried in which prisms base in are used. First the patient is directed to look at a distant image to help decrease convergence. Gradually the exercise can be done at closer range and finally at near range. For physiologic diplopia, the Remy separator, diploscope, and bar reading with a red glass over the dominant eye are used. The stereoscope with slides that do not permit the patient to converge is interesting to use and aids in developing ability to fuse. The Ortho-Fusor with its three-dimensional pictures is handy for home use. With polaroid glasses the images of the two pictures are fused. Some images are fused with an overconvergence and others with an excessive divergence. When the amount of esophoria is not the same for distant and near vision, we would emphasize working at the distance where help is needed most — depending upon whether there is a divergence insufficiency or a convergence excess.

Now to consider stimulating convergence in cases of divergent strabismus and exophoria. In cases of strabismus when diplopia is recognized, recession exercises with a red lens and work on the cheiroscope are good. The diploscope and Remy separator are used for these cases also. The distance that is emphasized most depends on whether divergence is excessive, convergence is insufficient, or both conditions exist. In many of these cases we use some of the home exercises that are used for exophoria. Prism exercises with base out prisms are used for both distant and near vision. It is in the cases of exophoria with a convergence insufficiency that base out exercises are most successful. The ability to converge is increased by gradually increasing the ability to overcome base out prisms and maintain fusion.

Often the amount of phoria is unchanged, but the convergence amplitude which will give the patient comfort is increased. Convergence on a finger, toy, or piece of candy is always a reliable exercise but often forgotten by patients because of its simplicity. Voluntary convergence can be taught by holding a light a few feet away from the patient while he fixes on his finger at 13 inches (33.02 cm.) from his eyes. This will produce two lights. After practice he should be able to obtain this physiologic diplopia without fixing on his finger. The use of physiologic diplopia also can be incorporated in daily activities by framing objects and bar reading. The stereoscope with base out slides is always good. Other means of stimulating convergence, such as the mirror with a star pasted in the center and stereograms of all types were demonstrated at our exhibit last fall.

Many things that I have mentioned can be used also for patients with concomitant hypertropia or hyperphoria. The object is to increase the restricted vertical fusion amplitude. The home work will consist of recession exercises, stereoscope with base out and base in charts, diploscope, Remy separator, and bar reading. When necessary these exercises can be done at first with a prism correcting the hyperphoria and then this can be gradually reduced until fusion is maintained without it. In this concomitant type of vertical deviation we do not expect to correct the hyperphoria but rather to relieve the patient's symptoms.

In the dissociated vertical divergence type of hyperphoria, time is spent learning voluntary fusion and diplopia — much the same as in an accommodative strabismus. This can be done with a red glass and light—first in a darkened room and later in a lighted room. As in cases of hyperphoria, the cheiroscope, stereoscope and diploscope are used at home. These aids are used to train the horizontal fusional amplitudes without the vertical corection which will aid in overcoming the hyperphoria.

Many more technics for home training could be added. This is only a review of what we have at our disposal for everyday use. We are constantly seeking new types of exercises which will stimulate our patients to make a real effort to bring about maximal visual coordination and visual comfort. Our ultimate aim in orthoptics is to achieve these results.

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MEASUREMENTS WITH COVER TEST VS. TROPOSCOPE

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NEARLY every orthoptic technician is aware that far measurements of heterotropia made with the troposcope and with the cover test are seldom the same in the same patient. It was the awareness of this difference that prompted the present study. One may ask several questions about such an observed difference: (a) What causes it? (b) Is it consistently present? (c) Is it significant? When the ophthalmologist measures the amount of deviation in a patient with heterotropia using the cover test and the orthoptic technician measures the deviation in the same patient with a troposcope, if the two measurements are not the same the question arises as to which measurement is correct. The answer is that both are correct but that they differ because of differences in the tests themselves.

Plan of Study

A sample of 200 patients with heterotropia was used. The lateral deviation of each patient was first measured by an ophthalmologist using the cover test and loose prisms. Measurements were made both at 20 feet (far) in the primary position and at 13 inches (near) with the gaze depressed in the reading position. These measurements were recorded and the patient was then taken to the orthoptic technician in another room. The technician was not shown the results of the cover test measurements but made her own measurements independently on a troposcope. The objective angle was measured at the optical equivalent of infinity and at the equivalent of near by the insertion of -3.00 D sphere into the lens holders on the eyepieces of the instrument. Alternate flashing was used to measure the deviation objectively on the troposcope. We are aware of the fact that the flashing technic frequently elicits a greater deviation than when it is measured with binocular fixation, but we chose the former because this method more nearly duplicates the conditions of the cover test. Troposcope measurements of the objective angle of deviation at far and at near were also recorded. Data for each patient's deviation at far and near by cover test and troposcope were finally recorded in tabular form.

Method of Analysis

There are several methods of handling data which are comprised of scores of measurements made on the same patient by each of two tests or measuring devices. The simplest method, that of a direct comparison of scores on two tests, was not applicable here because of the variations encountered in individual patients.

Taking the mean or average of the total scores by each of the two methods would have had some significance, but if score differences were not consistent, this would be hidden by considering only the mean.

Computing the correlation coefficient between scores by each of the two tests seemed to offer possibilities. The coefficient for far scores on the troposcope and on the cover test was found to be

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+ 0.80; for near, the coefficient was + 0.79. It is apparent from these two values for r that computing correlation coefficients for near and far scores, while of value, did not throw any light on the problem of the difference under consideration. The fact that r is practically the same for far and near measurements on the troposcope and cover test and that it is high enough to be significant is to be interpreted as meaning only that the two tests rank patients in approximately the same order of amount of heterotropia even though actual scores might be quite different.

We can illustrate the significance of the correlation coefficient applied in this way with an example. Suppose one has five patients—call them A, B, C, D, and E. All have esotropia. When measured with the cover test and loose prisms, A has 1 diopter of esotropia, B has 2, C has 3, D has 4, and E has 5 diopters. When the same patients are measured on the troposcope, A has 5 diopters, B has 10, C has 15, D has 20, and E has 25 diopters. On both tests—cover test and troposcope—A has the least esotropia, E has the most, and B, C, and D are ranked in that order by both tests. In order of the amount of eostropia that is found in each patient, beginning with the smallest deviation, the cover test ranks them in the order of A, B, C, D, E. The troposcope ranks them in the same order. On the troposcope, A had 5 diopters of esotropia, while on the cover test he had only 1 diopter; on the troposcope, E had 25 diopters of esotropia, while on the cover test he had only 5 diopters. Nevertheless, the two tests, although giving different measurements for the amount of esotropia in each patient, *rank patients in the same order* and thus have a perfect correlation, that is, a correlation coefficient of + 1.00.

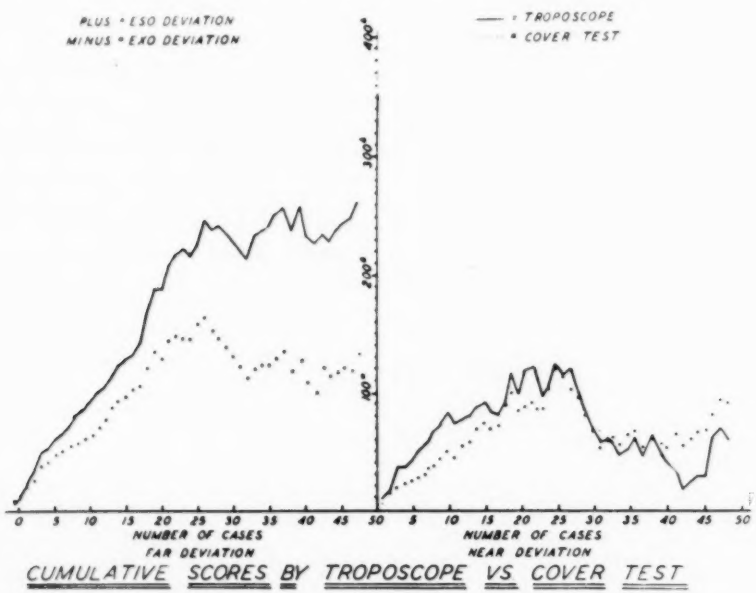


FIGURE 1.

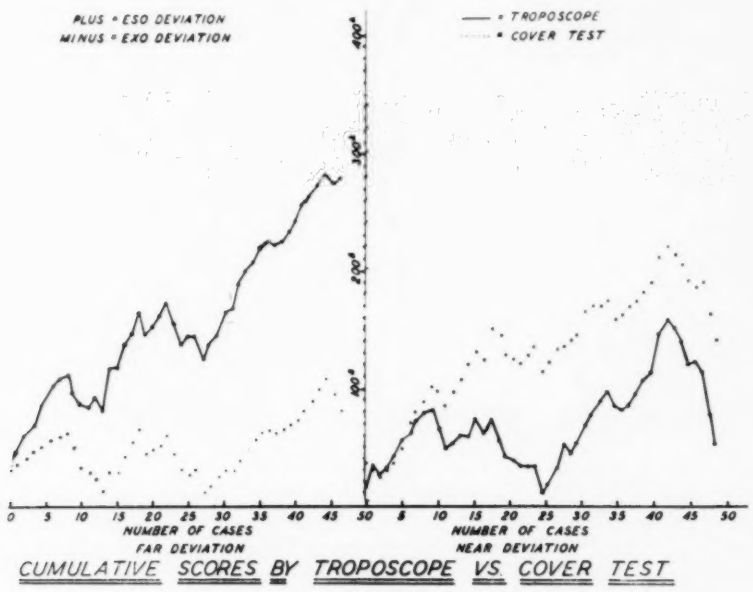


FIGURE 2.

So much for the example. Turning to the actual situation, r for the two tests —troposcope and cover test—was found to be +0.80 for far and +0.79 for near. This means that approximately 80 per cent of patients with esotropia will be ranked in the same order by the two tests; the remaining 20 per cent will be out of order. The correlation coefficient tells nothing about actual scores on the two tests.

A variation of the method of cumulative frequency was decided upon as being best suited to answer the question raised in the beginning. If the patient had esotropia, the measurement was recorded as being plus, while exotropia was recorded as minus. On the first graph, at the left, measurements of the deviation at far for the first patient were recorded for each test; measurements for the second patient were added to those for the first and these were next recorded as the second pair of dots (fig. 1). The third pair of dots represent the sum of measurements by each test on the first three patients. The last (the fiftieth) pair of dots represent the cumulative measurements by each test for the first 50 patients. Near measurements were similarly plotted at the right of the graph. The size of the graph limited the sample shown to 50 cases. Three other groups of 50 each are shown in the succeeding charts (figs. 2, 3 and 4). The last graph is a summary plot (fig. 5). Each dot represents a group of 50 patients and the whole sample of 200 patients is represented on this plot. The results are clearly shown and leave no room for doubt. The troposcope consistently elicits greater amounts of esotropia, and less exotropia, at far than does the cover test. At near, however, measurements on the two tests are practically the same and may almost be used interchangeably.

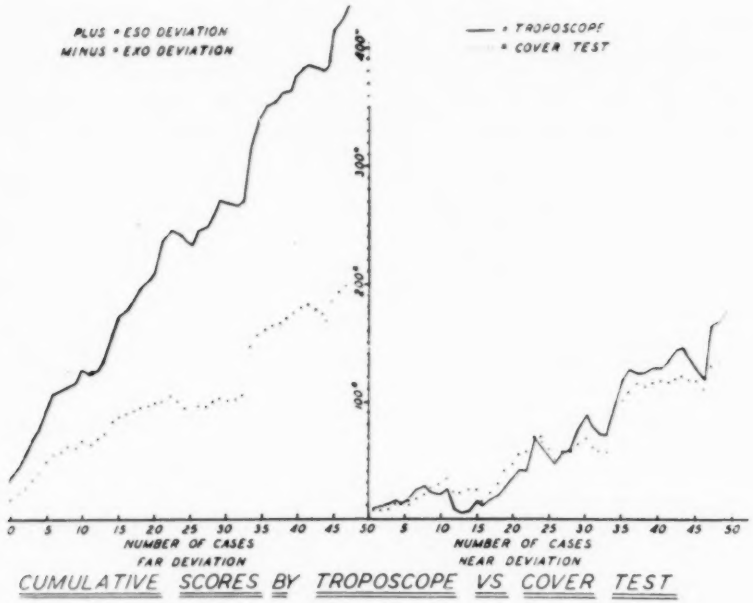


FIGURE 3.

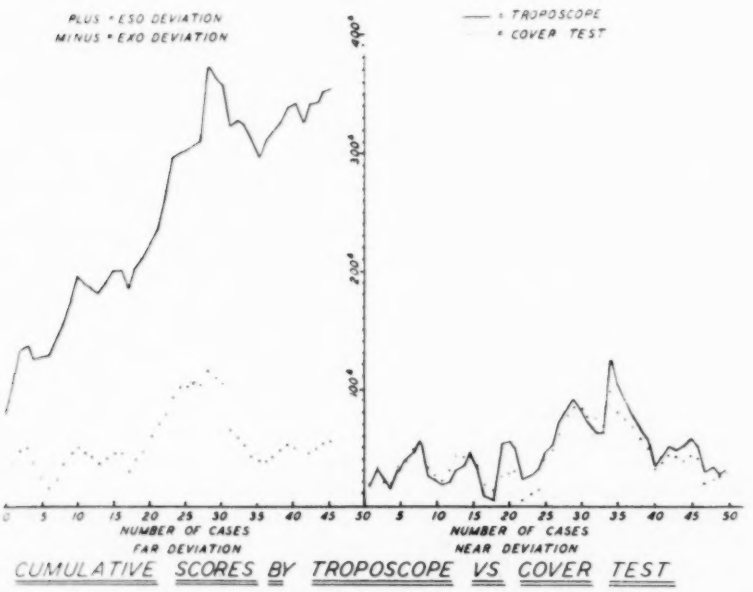
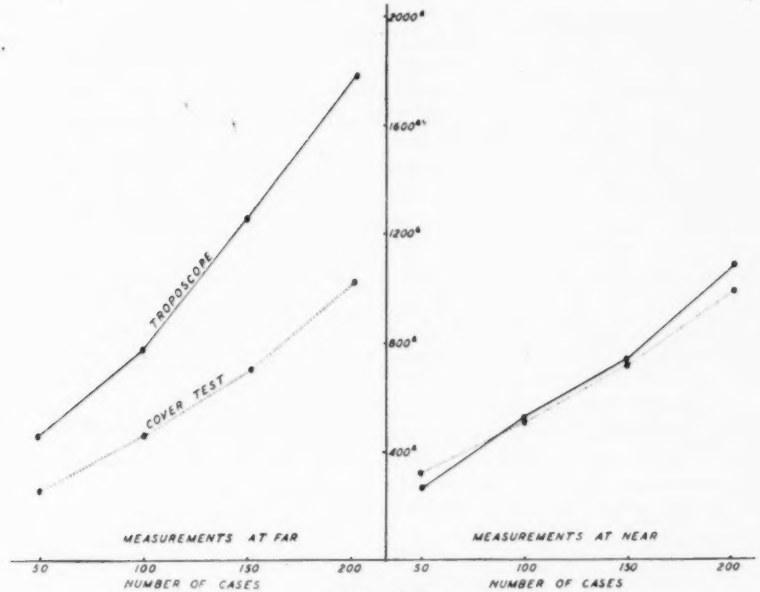


FIGURE 4.



SUMMARY

FIGURE 5.

Discussion

The clinical observation had been made that at far the troposcope seemed to elicit more esotropia than did the cover test. The danger in clinical observations, unsubstantiated by data, is that one is apt to remember only those cases which happen to fit the theory in vogue at the moment while cases which disagree are forgotten with surprising facility. If a real difference is in fact present and if it is consistent, then proper handling of data will reveal it. The steeper slope of the curve for troposcope measurements of deviation at far, as compared to that for cover test measurements at far, is easily apparent. It is obvious that there is a consistent difference and that it is significant despite the relatively high correlation between the two methods. It would have been nice if the "curves" had turned out to be straight lines because it would then have been possible to calculate regression equations for each line. With such equations it would be possible to take a far measurement of esotropia made on a troposcope and to calculate what the cover test measurement would be for a given patient, and vice versa. It would be possible to convert troposcope measurements to cover test measurements. Since the curves *are* curves and *not* straight lines, this is not possible.

It is interesting that the curves for near measurements on the troposcope and cover test almost coincide. It is obvious that the position of gaze during the cover test at near can not be duplicated on the troposcope. When the cover test is done at near the eyes are depressed in the reading position, while it is impossible to depress the tubes of the troposcope to allow a similar position of the eyes. In spite of this condition there is no obvious difference be-

tween measurements made by the two methods at the near distance. In general therefore, it is possible to substitute near measurements made with the troposcope for those with the cover test and vice versa. The two tests may be expected to give almost identical measurements of esotropia at near in the same patient.

What is the explanation of the difference between the two tests at far? Absolute proof is lacking, but it seems very likely that the difference is the result of what has been variously referred to as instrument accommodation, instrument reflex, machine reflex, machine accommodation, the near reflex, and the awareness of nearness. Far measurements on the troposcope are made at the optical equivalent of infinity. As the patient takes his seat before the machine, he is well aware that the target slides he sees are quite close to him—9 inches away, to be exact. Despite the fact that the optical system is set at the equivalent of infinity, the near reflex stimulates a certain amount of accommodation, which is in turn associated with the convergence response to the awareness of nearness. This probably is manifested in an increased amount of esotropia over that found when the deviation is measured while fixating a muscle light. The fixation object actually is 20 feet away — rather than artificially so. Instrument accommodation is the generally accepted explanation for the apparently greater amounts of esotropia uncovered at far by the troposcope than by the cover test.

At near both troposcope and cover test have the target actually at near, so that the awareness of nearness or the near reflex is called into play *by both tests*. Since the chief difference between the two is thus eliminated at near, one would expect the measurements by the two on the same patient to be almost identical and the data have shown that they are.

The data for this study were taken from the files of Dr. Richard G. Scobee —his private patients and patients from the Motility Clinic, Washington University. The cover tests were done by Dr. Scobee. I want to thank Dr. Scobee for his generous cooperation and helpful advice during the preparation of this paper.

SUMMARY

Measurements of heterotropia at far on the same patient by troposcope and by cover test with loose prisms are not the same. The troposcope consistently reveals more esotropia and less exotropia at far than does the cover test. The difference between the two methods is significant and is probably produced by the factor of instrument accommodation or the awareness of nearness. Near measurements of heterotropia on the same patient by the two methods are practically identical and are thus interchangeable.

The correlation coefficients for near and for far measurements of heterotropia by the two methods are significantly high; for far it is + 0.80, and for near, + 0.79.

NYSTAGMUS TREATED BY ORTHOPTICS

ELECTRA HEALY
CHICAGO, ILL.

THIS is a report of observations made on 4 patients with congenital nystagmus as well as esotropia. The distinguishing characteristics of each case together with the method of treatment employed are described in some detail. There is almost no literature on the treatment of nystagmus and, while only 4 cases are reported here, it is hoped that further work and study will be stimulated in those interested in the subject.

CASE 1. The first patient was seen in 1942 when she was 12 years old. The diagnosis was one of congenital nystagmus and right esotropia. The esotropia had become quite obvious by the age of 2 and glasses has been worn for the past eight years.

Upon orthoptic analysis, there was a right esotropia of between 40 and 45 prism diopters. The use of a cover in performing the cover test resulted in a marked exaggeration of the nystagmus. The movements were coarse horizontal ones, and it was noted that the speed of the nystagmus was increased when glasses were worn. The patient was hypermetropic but was wearing an undercorrection of the hypermetropia. Ductions and versions both were normal and so was the near point of convergence.

The patient reported simultaneous perception with first grade targets on a major amblyoscope set at zero and diplopia was homonymous. As the arms of the machine were moved inward (base out), the images were reported to be approaching each other and, finally, the bird was seen in the cage at a setting of 44 diopters base out. Fusion had occurred at the estimated angle and it was also noted that *all nystagmus had stopped*. The corneal reflexes in this position were fairly well centered. When either eye was covered, the nystagmus returned, but when the patient was allowed to fuse at the angle of deviation, nystagmus disappeared. No fusional amplitude could be demonstrated, either divergence or convergence, nor could fusion be maintained in either dextroversion or levoversion. Because the nystagmus had been abolished temporarily when fusion occurred at the patient's angle of deviation, it was decided to begin orthoptic training on an experimental basis.

The patient was placed before an amblyoscope, without glasses, and told to make every effort to hold fusion. Second grade targets were used, the arms were locked at the angle of deviation, and then moved from side to side. When 10 degrees of lateroversion had been secured with the nystagmus still controlled, effort was directed toward obtaining some degree of amplitude. Eventually a full excursion was attained from side to side and then all efforts were directed toward obtaining amplitude.

The goal of these two exercises—lateroversion and amplitude—was, of course, to enable the patient to use in casual seeing the ability that had been demonstrated on the major amblyoscope in order that supplementary home work might be assigned.

A 3 mm. white-headed pin was inserted in the end of a pencil and held at the angle where fusion occurred and nystagmus stopped. It was moved from side to side until full excursions were obtained and then recession exercises were begun. From this point, progress was suprisingly rapid. Within a matter of days, the patient could fuse a muscle light 20 feet away. She could also attain all three grades of fusion on a major amblyoscope set at zero and had amplitudes of from 5 prism diopters base in to 60 prism diopters base out. Nystagmus by this time was under control except in extreme lateroversion. Binocular visual acuity was 20/20 both with and without glasses. Although plus cylinders could by this time be worn without appearance of the nystagmus they were soon discarded.

Nine visits were all that were required and, as a matter of fact, the last three visits were devoted chiefly to stabilization. Observation at intervals of six weeks was continued for the next few months. The patient has been followed regularly for the past nine years. She is now 22 years old, has attended college, taken a secretarial course, and successfully holds a position requiring constant use of her eyes.

Case 2. A boy, 3 years old, had horizontal nystagmus present from birth and a right esotropia of approximately 45 prism diopters. His refractive error under atropine amounted to +1.00 +2.00 ax 90 in each eye. Because of the experience in the first case, his ophthalmologist was asked to prescribe only the cylinders, and this was done. Even the cylinders had the effect of exaggerating the nystagmus, but it was believed necessary to correct this amount of astigmatism in order that visual acuity might be at its best.

He was kept under observation at intervals of four months until he reached the age of 5, at which time his cooperation was such that a satisfactory determination of his fusional status could be made. On a major amblyoscope he, too, had simultaneous perception and homonymous diplopia at a zero setting. He fused at 42 prism diopters base out and all nystagmus stopped at this point. A year later, his visual acuity was 20/40 in the right eye and 20/20 in the left eye with glasses. At this time it was noted that occlusion of either eye resulted in a marked increase in the rate of nystagmus. In the interest of securing equal acuity in the two eyes, however, the left eye was occluded and home work prescribed. After a month of occlusion, the acuity in the right eye was 20/20 and the patient's angle of deviation had decreased to about 20 prism diopters. When he finally reached the age of 7, the routine of therapy described for case 1 was begun and satisfactory results obtained after six weeks. Cylinders in the prescription were gradually reduced and finally discarded by the time he was 8 years old. He now attends school, studies music and participates in sports, and his nystagmus is well controlled.

Case 3. A girl, seen for the first time at the age of 10, differed from the other patients described in that she had had an operation for esotropia at the age of 4. The esotropia had been reduced little if at all by the surgery and the nystagmus had remained unaffected. Suppression amblyopia was present in the deviating eye. Constant occlusion was instituted and her visual acuity rose from 20/200 to 20/25 in the amblyopic eye in less than three months.

On a major amblyoscope, homonymous diplopia was present at zero and fusion occurred at a setting of 42 prism diopters base out and 3 prism diopters of vertical. The nystagmus disappeared when fusion occurred at the angle of deviation.

The usual exercises were employed until a relative prism divergence of 12 diopters was attained but, despite this, the angle of deviation for casual seeing showed no apparent reduction and no further progress could be made. Because the nystagmus was controlled within the patient's fusional range, it was decided that the prognosis with further surgery should be good, and this was happily proved to be so. One operation reduced the esotropia from 42 to 20 diopters and a second operation a year later abolished the esotropia entirely. Reduced plus cylinders were worn during the intervening year but were discarded entirely a month after the last operation.

Case 4. A girl of 7 had nystagmus, esotropia, and a vertical component which resulted in head tilt. After occlusion because of amblyopia, treatment was begun at the fusion angle of 40 prism diopters base out and with the vertical variable. After she had acquired the ability to hold fusion for a complete lateral excursion and with some degree of amplitude, a fine rotary nystagmus was noted for the first time.

It was found that by returning to the original angle of deviation, placing emphasis on decreasing the vertical, and then stabilizing fusion, the best results were secured. When this had been accomplished, work on the amplitudes was resumed. Home work was prescribed, especially on convergence, and later recession exercises were instituted.

At present, the head tilt is no longer noted and fusion is being stabilized for distance. The vertical component is an obvious obstacle, but it is believed that fusion can be stablized in spite of it and no surgery is anticipated. The nystagmus is well controlled within the fusion range. It is of interest that twice during the incubation period of severe illnesses, the nystagmus in this patient returned for a brief time.

DISCUSSION

Careful study of the 4 cases presented strongly suggests that nystagmus of the type described is an anomaly of the fusion mechanism. A variation of this type of nystagmus may have been encountered in a man of 32 who had no significant deviation, could fuse at zero on a major amblyoscope, but whose nystagmus did not decrease at all under these conditions. The nystagmus was minimal in dextroversion and maximal in levoversion. He could fuse at zero with second grade targets and the usual routine of orthoptic treatment was followed. After five sessions, the nystagmus was believed to have been reduced to about one-fourth of the original amount. His family reports that his nystagmus is now directly proportional to the amount of fatigue present and that, at times, no movement is noted grossly in the eyes-front position.

With regard to the type of nystagmus described in the 4 cases, several generalizations may be made:

1. All patients were hypermetropic and correction of any amount of either hypermetropia or astigmatism, or both, appeared to accelerate the nystagmus. However, after treatment is completed, a refractive correction could be worn, if necessary, without causing a return of the nystagmus.

2. Anomalous correspondence was not found in any patient. This, I believe, may be due to the fact that the constant shifting of retinal images makes the selection of any particular neuronic pathway impossible.

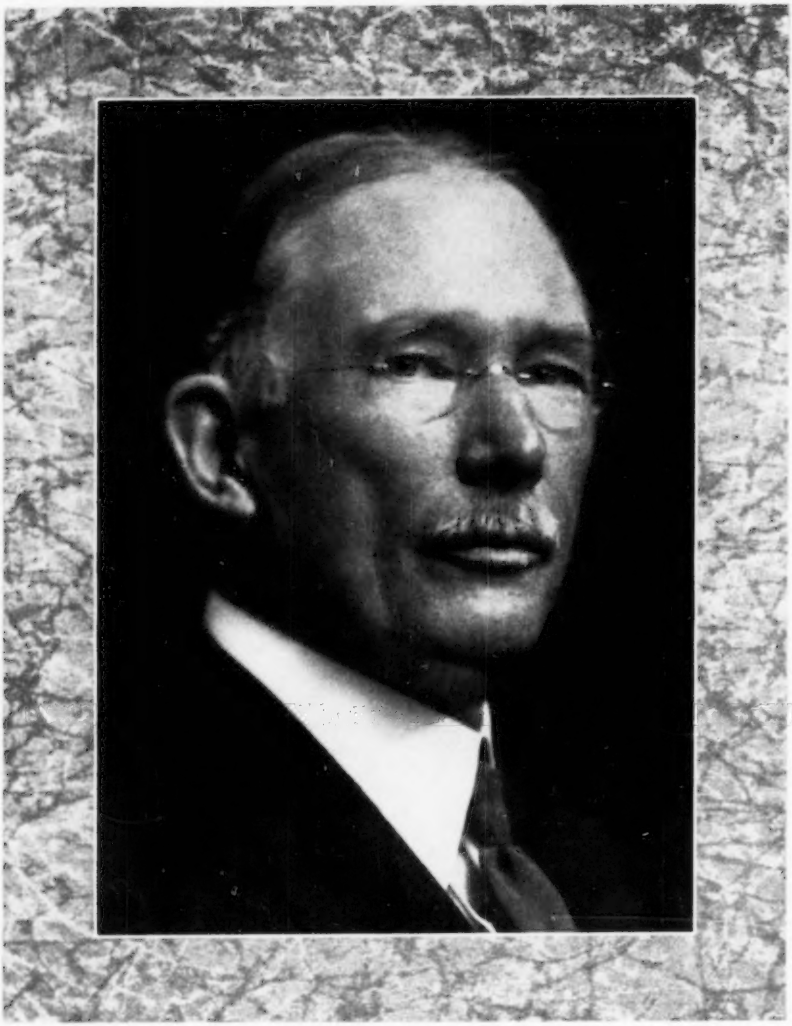
3. Visual acuity in the amblyopic eye seems to return more quickly than in the average case without nystagmus. This is perhaps because the suppression is less well developed in these patients.

4. A varying degree of nystagmus may be found in the extreme lateral positions of gaze even after treatment.

CONCLUSION

The particular type of nystagmus described appears to be an anomaly of the fusion mechanism and may be controlled entirely, except in extreme lateral positions of gaze. A variation of this type, or a separate type with some of the same elements, may be partially controlled with treatment. Correction of any hypermetropic refractive error results in an exaggeration of the nystagmus. The response to occlusion is good despite the fact that occlusion of one eye often results in exaggeration of the nystagmus. The prognosis for fusion with surgery is good if there is any response to the routine of treatment described and if there is still a residual esotropia.

In Memoriam



WALTER BRACKETT LANCASTER

1863 - 1951

AMERICAN ORTHOPTIC JOURNAL

Published Annually as a Supplement to the Transactions of the American Academy of Ophthalmology and Otolaryngology

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Editorials

This memorial issue of the American Orthoptic Journal is an unusual one. In it we have attempted to give proper recognition to Walter B. Lancaster, an ophthalmologist who contributed greatly to ophthalmology for over a half century and was active until his death at the age of eighty-eight. This tribute, and the recounting of his contribution and his honors, was prepared by the Editor of the Journal, Dr. Richard G. Scobee.

With a great sense of loss, we must now announce the death on June 22, 1952, of Dr. Scobee, only a few weeks after he turned in the completed copy for this issue of the American Orthoptic Journal. His death at the age of thirty-eight years cuts short a brilliant career and leaves a host of personal and professional friends to carry on, as best they can, the excellent work he had begun.

Two physicians, one who had lived fully a prolonged professional career, and one who had yet to attain midstream in professional life, have left us. The American Orthoptic Council and the American Association of Orthoptic Technicians shall particularly feel the loss.

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Orthoptic Technicians

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American Orthoptic Council

FRANK D. COSTENBADER, M.D.,
Secretary-Treasurer
American Orthoptic Council

WALTER BRACKETT LANCASTER
1863-1951

An Appreciation

December 8, 1951, marked the passing of a friend.

This issue of the AMERICAN ORTHOPTIC JOURNAL is dedicated to that friend. The goal of this appreciation is not to list his scientific achievements and honors. These are legion and have been adequately listed in the ophthalmologic journals.

Walter Lancaster was unquestionably one of the most outstanding figures in ophthalmology. It is not, however, as the eminent scientist which he was that we prefer to remember him but as a friend. His bushy white brows, twinkling blue eyes, and deep voice which could express scientific fact or whimsical fiction with equal facility will not soon be forgotten. His frequent comment . . . "Oh to be eighty again!" endeared him to many. One writer stated that Walter Lancaster accomplished more between the ages of sixty and eighty-five than most men are able to do in a lifetime.

Candidates taking examinations of the American Board of Ophthalmology were frequently presented with his glasses and the remark, accompanied by a twinkle of the eyes, "What do you think of these?" Part of Walter Lancaster's interest in disturbances of ocular motility undoubtedly came from the fact that he himself had one which was adequately compensated by prisms. To many an apprehensive candidate, Dr. Lancaster's glasses with both horizontal and vertical prisms represented a terrifying enigma. He was delighted on one occasion when a friend, after examining the lenses, offered to prescribe a better pair.

During his early days in medicine, Dr. Lancaster desired to spend some time studying in Europe, and this he did. When he arrived at one well-known English hospital, he found that the class of the Chief of the Eye Service was already filled. There was, however, a young instructor who had no students at all and so Walter Lancaster enrolled with him and studied with him for several months. "That instructor," grinned Walter Lancaster, "was Ernest Maddox!"

It was a rare privilege to sit at the side of Walter Lancaster and listen to anecdotes about famous men in the field of ophthalmology—men who are but names to most of us but whom Dr. Lancaster knew well. His stories made them live again.

One of his greatest achievements in the field of orthoptics was the initiation of what is now known as the American Orthoptic Council's Summer Course. Not only did he start this course but it remained under his direction as long as he lived. He held the firm belief that an orthoptic technician should be firmly grounded in anatomy, physiology, and optics. His concept of the role of the orthoptic technician in medicine was crystal clear. The many technicians who sat in his classes will always be grateful for the knowledge which was his to impart.

Gentle, thoughtful, kind, honorable, sincere, scholarly, humorous, philosophical — Walter Lancaster was all of these and more. He is no longer with us in the flesh and that is our loss. His work, his thoughts, and his spirit remain and that is our gain. His place in American orthoptics was unique. It can never be filled by another.

RICHARD G. SCOBEE, M.D.

RICHARD G. SCOBEE

1914-1952

Orthoptics lost one of its great champions when Richard G. Scobee died suddenly of coronary occlusion on the evening of June 22, 1952.

Born in Sherman, Texas, on November 14, 1914, he spent much of his early life in El Paso, moving later to Houston, Texas. He completed his premedical work at Rice Institute in Houston, and received the A.B. degree from that school in 1935. He was graduated from the University of Texas Medical School in 1939, after which he served a rotating internship at the Methodist Hospital in

Fort Worth, Texas. In July, 1940 he came to St. Louis for specialized training in ophthalmology at the Washington University School of Medicine and completed his residency training at Barnes Hospital in St. Louis in 1942. He was certificated by the American Board of Ophthalmology in 1943 while working as a full-time instructor in the Department of Ophthalmology of the Washington University Medical School. In January, 1944 he entered the Air Force, then a branch of the Army of the United States, and was assigned to the Department of Ophthalmology of the School of Aviation Medicine at Randolph Field, Texas. In September, 1945 he returned to St. Louis as Director of Graduate Training in Ophthalmology at Washington University School of Medicine, a position which he held at the time of his death. He was promoted to the rank of Assistant Professor in 1948.

Dr. Scobee's interest in ophthalmology began even before his medical school days and it was his constant goal throughout his school years to learn all there was to know about his specialty. During his internship, he became interested in obstetrics, and were it not for the fascination of his first love—ophthalmology—he might have become an obstetrician. We are thankful that this did not occur for we now realize how much he has contributed to ophthalmology, especially toward the solution of the many unsolved and mysterious problems in ocular motility.

Assignment to the School of Aviation Medicine at Randolph Field in early 1944 perhaps furnished the situation which was to stimulate his interest in the problems of ocular motility. There he was confronted with many problems concerning normal and abnormal muscle balance which needed immediate answers. In many instances, there were no good answers available so he set about to find them. That he often accomplished his goal is indicated by the many project reports published by the School of Aviation Medicine summarizing his work. The large number of reports indicates the enthusiasm and energy he always seemed to have. Fascination with ocular motility continued after his return to St. Louis in 1945 when he reorganized the "Muscle Clinic," a branch of the General Eye Clinic in the Washington University Clinics, which he supervised until his death. From the first he was keenly aware of the need for orthoptic help and was able to obtain the services of a qualified orthoptic technician late in 1948. Later he organized a training program for orthoptic technicians in his clinic and at the time of his death, his organization employed two full-time technicians, and had just completed training five student technicians. In addition to these local efforts to further the cause of orthoptics, he was instrumental in organizing the instruction courses for orthoptic technicians now held each fall in conjunction with the Academy meeting and the meeting of the American Association of Orthoptic Technicians. Also, he was in charge of the Summer Instruction Course given by the American Orthoptic Council, and was the first editor and guiding light of the AMERICAN ORTHOPTIC JOURNAL.

Dr. Scobee is survived by his wife, his children, and his parents.

It is a peculiar twist of fate that he had just recently written Dr. Walter Lancaster's obituary, which is carried in this memorial issue with his own.

All who knew him will revere his memory and miss the stimulus of his presence. His was a life that ended too soon.

DAVID W. FREEMAN, M.D.

THE CHALLENGE OF ORTHOPTICS

Orthoptics represents a veritable challenge to the student and an interesting challenge to the established orthoptic technician. There is a boundless wealth of knowledge to be discovered and absorbed by the orthoptic technician. To obtain progress in the field and meet the never-ending problems, the orthoptist is more or less obligated to keep abreast of the current literature, for it is only by knowing the theories presented that one is able to find the solutions to the pressing problems. Not only must we keep informed but we must also contribute what we can in order that collectively we may gain from the individual.

THE AMERICAN ORTHOPTIC JOURNAL is a new addition to the field. We hope that by contributing new and constructive ideas it will maintain its rightful place in orthoptics. As you know, the papers published in the JOURNAL represent those which the editor hopes will be of value to you. The Abstract Committee has selected the pertinent articles that might be of interest and they have tried to present them as lucidly as possible.

To those who have contributed to the JOURNAL we extend our appreciation for their spirited efforts.

NANCY CAPOBIANCO

PROFESSIONAL RESPONSIBILITY

The orthoptic technician has only recently come into being as a medical affiliate, and in some circles is not accepted as such even yet. This position of incomplete acceptance imposes certain responsibilities which the technician and the ophthalmic medical practitioner must recognize and face squarely.

Technicians come from many social and educational walks of life and begin their careers at varying ages. Ophthalmologists, on the other hand, have similar premedical educational requirements, conform to somewhat standard professional training, and begin their careers at about the same ages. These differences in training of the technician and the ophthalmologist may at times cause friction. Fortunately, this happens infrequently, since a greater understanding of each other's problems is more often possible.

The orthoptic technician can do much to improve further this understanding by recognizing a threefold responsibility. This responsibility is to the medical public, the medical practice and progress, and to the cooperating or employing ophthalmologist. The patients and the parents are in the hands of the orthoptic technician. They are not able to recognize the difference between good and poor orthoptics. Many times the ophthalmologist can't either. The patient doesn't know whether his time is being used to the best advantage, whether his convenience is being reasonably considered, whether treatment is being well correlated by technician and ophthalmologist, or whether medical honesty, in its best sense, is being served. The technician must be a judge of these things. And on her rests the future of combined ophthalmic and orthoptic practice.

The technician has the further responsibility of frequent consultation with her employing ophthalmologist. She must tactfully refuse to treat patients who cannot profit by treatment. She must encourage further treatment when progress is being made. She must make sure that the termination of her employment does not seriously interrupt important treatment. She must do everything in her power to aid in the training of new technicians.

All of these things are a heavy load for an almost new group of medical affiliates to carry, but to the gratification of the American Orthoptic Council, this burden is being carried increasingly well. Orthoptic technicians are growing in numbers, in knowledge, and in professional responsibility.

FRANK D. COSTENBADER, M.D.

ZERO VS. ORTHOPHORIA

The meaning of zero is widely known. It requires no definition.

The meaning of orthophoria is, by definition, the absence of any deviation of the eyes from the functional primary position when fusion is disrupted and the two eyes thus dissociated.

Orthophoria means zero deviation under certain specified conditions. Orthophoria and zero are not synonyms and certainly they are not interchangeable, although they are frequently used as if they were.

"The patient relaxed to orthophoria" is often heard and yet a moment's consideration will reveal that it is a ridiculous statement. The mere fact that the patient *had* to relax means that orthophoria was certainly not present — far from it. The speaker usually means that such a patient was able to give up a sufficient amount of convergence to superimpose targets at a zero setting on a major amblyoscope. Those who use the expression seem to derive a peculiar exhilaration from speaking of orthophoria instead of the zero point on a scale. As a matter of fact, orthophoria is a theoretical ideal that is seldom encountered clinically. Whether or not a patient will appear to have orthophoria will depend to a certain extent upon the test used.

In true orthophoria, the foveas of both eyes remain aimed accurately at the object of regard even though one eye is blocked as it is in the cover test. If true orthophoria is indeed present under these circumstances and the cover is then shifted from one eye to the other, there will be no perceptible apparent movement of the object of regard; in other words, the phi phenomenon will not be noted. The patient with fusion who will fail to perceive any apparent movement of a muscle light twenty feet away as a cover is shifted from one eye to the other and back again is indeed rare. When using the cover test, orthophoria seems almost nonexistent.

If the Maddox rod test is employed, patients who see a vertical line running through a light in the absence of any prism held either base in or base out are much more common. With the Maddox rod test, however, the patient who is truly orthophoric for both far and near is very unusual. A certain amount of exophoria at near is considered physiologic by most investigators. One is forced to regard with frank skepticism any statement to the effect that a patient is orthophoric for *both* near and far by any test. Statistically, such a situation occurs less than one out of a thousand times and would be considered such a rarity as to be almost an abnormality.

"This patient varies from 20 prism diopters of esotropia to orthophoria!" Such a report is certainly not rare and it is certainly not true. The patient's deviation may vary from zero to 20 prism diopters, but the very fact that heterotropia is present automatically excludes orthophoria completely.

One also hears oculists and orthoptic technicians alike say, "We got orthophoria in this case." Neither oculist nor technician *got* orthophoria. The patient may have been found to be orthophoric following certain surgical and nonsurgical proceures. The patient attained orthophoria—not the oculist nor the technician. They merely helped.

It is perfectly true that when orthophoria is thus misused for zero, the meaning of the speaker or writer is usually clear to the listener or reader. It is, however, equally true that the speaker or writer is guilty of sloppy and inaccurate usage of words. It is no more effort to say or write a thing correctly than incorrectly and the results are certainly more accurate. A good place to begin is with orthophoria and zero.

†RICHARD G. SCOBEE, M.D.

† Deceased

ANNUAL MEETING

Twelve instruction courses at the graduate level for orthoptic technicians were made available at the annual meeting in Chicago in 1951 for the first time. Four hundred tickets were sold. During the 1952 meeting, twelve courses will again be presented and they are listed in a subsequent paragraph. These courses are open *only* to (1) members in good standing of the American Association of Orthoptic Technicians and (2) orthoptic technicians who have passed the examination for certification by the American Orthoptic Council but have not yet been formally elected to membership in the A.A.O.T. Tickets may be reserved in advance by those who have paid their dues for 1952. In order for members to assure themselves of tickets for the courses they desire, it is advisable to order tickets in advance. Tickets also may be obtained at the time of registration at the meeting at a desk provided for that purpose. Each technician may take a maximum of six courses, three on Monday morning and three more on Tuesday morning.

1952

COURSES FOR ORTHOPTIC TECHNICIANS

COURSE OT1

Room 702 Period M-3 or T-3

HOME TRAINING TECHNICS IN ORTHOPTICS

Mary W. Argue
Baltimore, Md.

COURSE OT2

Room 702 Period M-1 or T-1

OPTICS FOR THE ORTHOPTIST

Paul Boeder, Ph.D.
Southbridge, Mass.

COURSE OT3

Room 713 Period M-2

THE TREATMENT OF SUPPRESSION AND AMBLYOPIA

Elizabeth Jackson
Erie, Pa.

COURSE OT4

Room 793 Period M-1 or T-1

ORTHOPTIC TREATMENT OF HETEROPHORIA IN ADULTS

Electra Healy
Chicago, Ill.

COURSE OT5

Room 702 Period M-2 or T-2

NEUROANATOMY FOR THE ORTHOPTIST

John W. Henderson, M.D.
Ann Arbor, Mich.

COURSE OT6

Room 743 Period M-2 or T-2

ORTHOPTIC TREATMENT OF VERTICAL DEVIATIONS

Mary E. Kramer
Kansas City, Mo.

COURSE OT7

Room 754 Period M-3 or T-3

DISSOCIATION TRAINING IN ACCOMMODATIVE HETEROTROPIA

Aleatha Tibbs
Washington, D. C.

COURSE OT8

Room 743 Period M-1 or T-1

STEPS TO FUSION

Julia E. Lancaster
San Francisco, Calif.

COURSE OT9

Room 743 Period M-3 or T-3

THE STEREOSCOPE AND ITS USE

Arthur Linksz, M.D.
New York, N. Y.

COURSE OT10

Room 713 Period M-1 or T-1

VERTICAL ANALYSIS IN HYPERPHORIA

Dorothy Thompson
St. Louis, Mo.

COURSE OT11

Room 793 Period M-2 or T-2

THE BLIND-SPOT MECHANISM

Kenneth C. Swan, M.D.
Portland, Ore.

COURSE OT12

Room 793 Period M-3 or T-3

TREATMENT OF ANOMALOUS CORRESPONDENCE

Frances Walraven
Atlanta, Ga.

Abstract Department

Nancy Capobianco, *Editor*

Only articles primarily of interest to the orthoptic technicians are abstracted. A series of 34 classifications for such articles has been designed. There are not abstracts for each class in any one issue of the JOURNAL.

The Abstract Editor would like to thank the following orthoptic technicians for their help in compiling the abstracts:

Leta Counihan
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Helen Fonzi
Dorothy Henderson
Virginia Koehler
Julie Mimms
B. Evelyn Taylor
Ellen Watson

CLASSIFICATION

1. Accommodation
2. Amblyopia
3. Anomalous Retinal Correspondence
4. Convergence
5. Cyclomovements and Deviations
6. Diagnosis
7. Diplopia
8. Divergence
9. Ductions
10. Esophoria
11. Esotropia
12. Etiology
13. Exophoria
14. Exotropia
15. Fusion
16. Heredity
17. Heterophoria
18. Heterotropia
19. Hyperphoria
20. Hypertropia
21. Instruments
22. Miscellaneous
23. Neuro-ophthalmology
24. Orthoptics
25. Paralysis
26. Refraction
27. Suppression
28. Surgery
29. Symptoms
30. Tests
31. Therapy
32. Vergences
33. Versions
34. Vision

1-1

Hill, Robert V.: *The accommodative effort syndrome; pathologic physiology,* Am. J. Ophth., 34:423-431 (March) 1951.

Dr. Hill's first report on the accommodative effort syndrome gives us a new viewpoint to think about. He presents a series of reports on diagnosing and effectively treating a common disorder of near-point muscle balance which is designated as the accommodative effort syndrone. The methods are based on a fundamentally different concept of the physiologic relationship of accommodation to convergence than that which has been generally accepted.

Bilateral adduction is the nasalward deviation of the two eyes for the purpose of effecting bifoveal fixation. Bilateral adduction is made up of two components.

1. Accommodative adduction which is an inherited reflex. The purpose of accommodative adduction is one of so aligning the visual axes that they are coordinate with the dioptric distance for any visual task. The stimulus to accommodative adduction is accommodative effort. An excess or insufficient amount of accommodative adduction requires a more gross adjustment of fusional movements in order to maintain bifoveal fixation. A squint may develop in infancy if these movements do not have a chance to develop and adults may complain of symptoms if too much weight is placed on these fusional movements.

2. "True" convergence is a finer, more accurate adjustment of the visual axis. "True" convergence may be positive or negative depending upon whether the fusional adjustment is convergently toward or divergently toward the normal dioptric coordinate for a given state of convergence.

He uses the terms "accommodative enhancement" and "accommodative inhibition" to denote the subconscious desire to keep the image clear.

When the patient is given a near-point visual task, there will be an increased stimulus to adduction, which in turn requires negative convergence to adjust for the normal dioptric coordinate. The negative convergence requires a relaxation of accommodation which is normally overcome by accommodative enhancement which if embarrassed will cause premature blurring when measured with base-in prisms at near.

The accommodative effort syndrome consists of:

1. Asthenopia with near vision, usually coming on within a few minutes after reading, sewing, etc.

2. Increased amplitude of accommodative adduction.

3. Abnormal relaxation of accommodation induced by relative divergence at near (prism base-in blurring at near).

4. Latent convergence insufficiency.

5. A mearsurable abnormality of accommodative function.

1-2

Peterson, John H. and Simonson, Ernst: *The effect of glare on accommodation near point,* Am. J. Ophth., 34:1088-1092 (Aug.) 1951.

A study is presented on the effect of glare on lens function in younger and older subjects. Glare was produced by a light bulb within a box 18 inches wide, 18 inches deep, and 20 inches long. The 200-watt light bulb was inserted at the end of the box and the subject faced the opposite end which contained an opalescent glass window. The subject's eyes were 7.5 cm. from the glass window. The glare exposure time was two minutes.

The studies were made on three groups: (1) 42 younger subjects between 20 and 42 years of age, (2) 36 older subjects between 49 and 80 years of age, and (3) 5 aphakic subjects between 60 and 78 years of age.

The younger group of subjects all had perfect visual acuity with and without lenses. The older subjects all had normal or within 10 per cent of normal visual acuity. The variations used were as follows:

1. Accommodation near point was determined before and after glare exposure without artificial pupil. (Artificial pupils were used in some of the experiments to rule out the effect of pupillary size on the measurements and also to cut down the amount of light entering the eye.)

2. Accommodation near point was determined before and after glare exposure with a 3-mm. artificial pupil being used during the exposure and all measurements.

3. Accommodation near point was determined before and after glare exposure with a 3-mm. artificial pupil being in place only during the measurements and removed during the glare exposure.

4. In the aphakic subjects, the near point of vision was determined before and after the glare with no artificial pupil being used at any time.

The effect of glare on accommodation showed the following:

1. In younger people, no effect was found.

2. In older people, a definite lengthening of the accommodation near point was observed.

3. In older aphakic subjects, no definite or significant change in the near point of vision was noted after glare exposure.

4. The change in the accommodation near point in older people is not due to a change in visual acuity.

5. The results agree with the known increased absorption of heat-producing rays by older lenses.

6. The results show that heat effects in the lens produced by the amount of glare used in this work produce a functional reversible change in the accommodation of older people.

1-3

Romaine, Hunter H.: *Fatigue of accommodation,* Eye, Ear, Nose & Throat Monthly, 30:140-142 (March) 1951.

The author believes that it is first necessary to ascertain the presence of fatigue of accommodation by a routine examination followed by a careful history which may disclose asthenopic symptoms when reading for an extended period of time; analysis of the discrepancies of the accommodative power for each eye singly or both eyes together; unsatisfactory muscle measurements or poor vergence test; and a thorough physical examination to disclose disease or foci of infection which may be underlying causes. Once the fact that the patient has fatigue of accommodation is established, any underlying causes which may aggravate the condition should be removed.

He describes the stimulation of accommodation and convergence, the use of spherical lenses and clip-on prisms to render the patient temporarily symptom-free and to enable him to study or work during the period of investigation.

1-4

Tait, Edwin Forbes: *Accommodative convergence,* Am. J. Ophth., 34:1093-1107 (Aug.) 1951.

This paper presents a detailed analysis of the heterophoric status for distance and near of over 4,500 cases from 10 to 70 years of age who had no ocular symptoms and had single binocular vision. It presents the nature of the accommodation-convergence reflex and the methods of classifications of its values, along with the distribution of the accommodative convergence.

Dr. Tait states that accommodative convergence may be defined as convergence which is induced by the presence of accommodative innervation when, by losing fusional control, the convergence is left free to respond.

After an extensive survey, he summarizes his results by stating that the nature and amount of heterophoria for distance depends on (1) the underlying heterophoria for distance, (2) the amount of accommodation or accommodative innervation present, and (3) the extent to which this accommodative convergence reflex is developed and operative.

2-1

David, Friedrich: *Über die gezieltes Training der Macula in der Amblyopiebehandlung,* Ophthalmologica, 121:149-153 (Feb.-March) 1951.

The article presents a method of aiding patients with eccentric fixation. It is designed to project images on the macula of these patients who do not fix with the macula. Diapositives were prepared to fit an ophthalmoscope. The treatment was carried out under cycloplegia. A picture was projected on the macula and the patient was made to name or describe it. When large objects are recognized, smaller ones are introduced. Four cases were successfully treated. The author hopes to publish a fuller paper later.

2-2

Hugonnier, R.: *Traitement de l'amblyopie strabique en practique courante,* Ann. d'ocul., 184:1030-1037 (Nov.) 1951.

The author has presented a review of the aims and methods of occlusion. The complete cure of strabismus includes development of binocularity and is not satisfied by parallelism of the visual axes. From all evidence fusion will never be good unless the eyes have equal visual acuity so, of necessity, amblyopia must be cured. In France active methods are not used because of unavailability of the complicated apparatus needed. Passive treatment, occlusion, of the better eye is used. For young children, the author recommends a patch made of a gauze pad covered by adhesive tape, which must cover the entire eye and come over the bridge of the nose. This must be worn day and night, and must not be interrupted by any pretext except to change the patch. For older children who will cooperate, a leather or rubber occluder mounted on the glasses so as to make a single unit, perhaps with an air vent, is recommended. In very young infants the author uses atropinization. One or two drops are used every day, every third day or once a week in the fixing eye. If alternation is produced, the atropine is used alternately in each eye according to which is the fixing eye at the moment.

Partial occlusion is used when the visual acuity has improved but is not yet normal. Types include: (1) bands of paper glued on the glass, 2 mm. wide, separated by a space of 1 mm.; (2) paper or cellophane glued on the glass in one or several layers; (3) Hamblin's Pugh occluders, glass of graded opacities

which reduces the acuity to a predetermined level.

Management of treatment by occlusion: Theoretically, total occlusion is continued until the deviating eye is no longer amblyopic. At this time, if the child can cooperate, orthoptic exercises should be given and the occlusion continued until binocularity is good enough to prevent recurrence of amblyopia. If surgery is indicated, it must be done without waiting too long. If, on the contrary, surgery is not done and the child is too young to cooperate, occlusion must be continued (unilateral or alternating). To abandon the occlusion and leave the child without orthoptic training or operative intervention will result in a return of the amblyopia.

Children aged 5 to 8: This is the age most frequently encountered by the author, perhaps through neglect of the parents, or more often because they have been content to use glasses, hoping they will correct the strabismus. Glasses should be prescribed, visual acuity measured and then total occlusion started. The child should be seen every 15 days and progress noted. He should be seated near the blackboard and the ordinary work of the class expected of him, making only reasonable allowances for the visual acuity. At home the child should draw, color, etc. Progress is frequently rapid in the first month or 15 days, then it is slowed down. It is unecessary to wait until vision is equal to start orthoptic training. 5/10 or even 4/10 (20/40 or even 20/50) is sufficient, bearing in mind that occlusion must be continued.

When should occlusion be abandoned? In general, if an acuity of 3/10 (20/60) is not obtained in three months, one must discontinue occlusion. Some parents insist that treatment be continued several months, others discourage it from the earliest moment. Practical difficulties dictate one's conduct.

When the visual acuity is subnormal but orthoptics has begun, part-time occlusion can start; it is understood that at the first sign of deterioration of acuity, total occlusion will be resumed.

Older children: Improvement is slower but cooperation is better at this age and one is sometimes happily surprised. Occlusion should not be discouraged too easily since it remains the sole chance of re-educating the amblyopic eye.

Children under 5: It is important to treat strabismus early. Visual acuity should be determined, if possible, with the Landolt broken rings or with E's. If acuity cannot be determined, the fixating eye should be determined by observation and occluded. The first follow-up should be in 15 days, then more frequently, for at that age there is often a reversal of the strabismic eye. In this case the occlusion is alternated. If improvement is not shown, an organic lesion should be sought. If improvement is shown, occlusion should be continued.

Once alternation is obtained, what should follow? *Occlusion must be continued until the visual axes are parallel*, whatever method is necessary to obtain this. In certain cases, occlusion and glasses will correct the strabismus but this is rare. If the child is old enough, orthoptics should be started. If not, the logical procedure is early operation.

Such early operation has not been accepted in France. However, the author believes this is the only procedure which at this age can bring about parallelism. If occlusion is sufficiently early, on the one hand amblyopia disappears and on the other hand abnormal retinal correspondence is not encouraged. After surgery, binocluar vision can develop; or one can aid it later, if necessary by orthoptics.

3-1

Burian, Hermann M.: *Anomalous retinal correspondence; its essence and its significance in diagnosis and treatment*, Am. J. Ophth., 34:237-253 (Feb.) 1951.

Dr. Burian discusses the aspects of normal correspondence and the normal binocular visual act and its adaptability to anomalous correspondence in the case of squint.

He states that while normal correspondence is innate, it is not so rigid that it cannot change should abnormal conditions warrant a change. According to the author, the sensory symptoms evolving from a profound upset in the visual act are only pathological exaggerations of physiologic phenomena. "Anomalous correspondence is an extension, as it were, of the assimilation of the visual directions within Panum's areas which normally takes place in sensory fusion."

Anomalous correspondence consists of rearrangement of the common visual directions of the retinal elements of the two eyes. The acquisition of anomalous retinal correspondence represents an adaptation of the sensory apparatus to the abnormal position of the eyes in an attempt to restore some semblance of binocular vision but which does not include stereopsis and in which retinal elements of markedly different visual acuity are connected.

He discusses the coexistence of suppression and anomalous correspondence and offers a conjecture on the neurophysiology of anomalous correspondence. He also lists (1) the position of the patient's eyes, (2) the consistency of the angle of squint, and (3) the use the patient makes of his eyes as highly important factors in the establishment of anomalous retinal correspondence. The process of establishing abnormal retinal correspondence requires time as well as individual adaptability.

He states that in a considerable number of patients both normal and anomalous correspondence may be elicited, but the ease of eliciting this depends on how deeply the anomalous retinal correspondence is rooted.

He discusses at length the clinical manifestations of anomalous correspondence in which he brings out the point that if the anomalous retinal correspondence is unstable, normal and anomalous localization appear successively in the same or different tests. There are, however, rare cases in which a normal and an anomalous response are elicited at the same time. These patients localize simultaneously in two visual directions with the deviated eye and are said to have monocular diplopia or binocular triplopia. He goes on to explain this in more detail.

The author lays a great deal of emphasis on the diagnosis of anomalous retinal correspondence and the importance of the orthoptic analysis, incorporating a plea to the orthoptists not to use just one test but to use as many tests as possible in determining the presence of anomalous retinal correspondence and its type. His discussion encompasses some of these tests in comprehensive detail as well as various methods of treatment.

He stresses the importance of "proper timing and cooperation between the doctor and the orthoptist" and that daily visits to the orthoptist, even for a relatively short time, are of much greater value than weekly or biweekly visits.

Orthoptic treatment of anomalous correspondence is a luxury and not every patient must be or should be treated. When treatment is undertaken it should be carried out to best advantage in fairness to both the orthoptist and the patient.

3-2

Jampolsky, Arthur: *Retinal correspondence in patients with small degree strabismus,* Arch. Ophth., 45:18-26 (Jan.) 1951.

Dr. Jampolsky deals in opposition to the Alder-Jackson, Travers statement that "the incidence of anomalous correspondence increases as the angle of strabismus becomes greater and that anomalous correspondence is seldom found in esotropia of less than 15 prism diopters."

The study has revealed the specific characteristics of the small angle esotropia: (1) the angle of strabismus is less than 15 prism diopters, (2) the strabismus is monocular in type, (3) anomalous retinal correspondence, usually of the unharmonious type, occurs in over 90 per cent of the cases, (4) there is a slight amblyopia of the deviating eye, (5) there is a high incidence of anomalous peripheral apparent "fusion," (6) there is an area of foveal or macular suppression of the deviating eye.

Two case histories are presented to illustrate the important points.

The methods of detecting these small angles of anomalous retinal correspondence depends upon the sensitivity of the test and the method of examination. The more closely the conditions of the method approximate the conditions of casual seeing habits, the more one is able to demonstrate the presence of anomalous correspondence, i.e., the major amblyoscope or the projection apparatus. The more closely the test simulates a laboratory experiment wanting in everyday visual cues, the less one is likely to demonstrate anomalous correspondence, i.e., the after-image test.

On the major amblyoscope, small targets must be used or larger ones so designed that one may detect differences of a few prism diopters.

As regards treatment, the author believes that "attempts to straighten the strabismus by orthoptic methods alone rarely, if ever, meet with success. The presence of an angle of strabismus or angle of anomaly of only a few prism diopters makes it almost impossible to convert the esotropia by orthoptic methods to normal correspondence with fusional amplitude and straight eyes, because the amblyoscope targets used in the usual orthoptic methods must be so small as to make orthoptic treatment impractical."

3-3

Schlossman, Abraham: *Diagnosis of abnormal retinal correspondence,* Eye, Ear, Nose & Throat Monthly, 30:25-28 (Jan.) 1951.

The author reviews the concepts of anomalous retinal correspondence and normal ret-

inal correspondence. The tests for determining anomalous retinal correspondence are presented, mainly the maculo-macular test (afterimage test) and the maculo-paramacular test (the amblyoscope and the double-image test). Patients with normal retinal correspondence have an excellent chance of obtaining a good binocular function through orthoptic and surgical procedures. If anomalous retinal correspondence is present, the prognosis is poorer. Patients with facultative anomalous retinal correspondence have a better prognosis than the ones who have a constant anomalous retinal correspondence.

3-4

Winkelman, J. E.: *Relative localization in abnormal correspondence*, Ophthalmologica, 119:116 (March) 1950.

In this paper the author describes experiments performed upon patients with periodic alternating divergent strabismus. These patients could achieve fusion in near vision but had an exotropia at the far point. The author states that in these subjects the experiments show that correspondence may be either normal or abnormal. When the patient is fusing, the retinal correspondence is normal. When the eyes are divergent, the correspondence is abnormal. He postulates that these people with intermittent exotropia have two different reflex pathways by which they localize objects. The one pathway is the same as that found in patients with normal correspondence. In discussing the other pathway, the author allies himself with Verhoeff in his views on abnormal correspondence. He believes that there is no combined pathway for localization in abnormal correspondence. Instead, there are two separate pathways for visual impressions, one for the right eye and one for the left. The stimulus received for each eye is localized according to the subjective median plane, and the stimuli from the two eyes are localized with respect to each other via this roundabout path. This indirect localization is much less precise than true retinal localization, and this accounts for the high degree of variability of the distance at which localization is correct.

The apparatus used was ingenious. Two movable boxes were equipped with point sources of light and filters polarized in opposite directions. The subjects wore glasses polarized in opposite directions, so that one eye saw only the light flash from one box and the other eye only the flashes from the other box. The boxes could be placed at varying distances from the eye and varying distances apart. The experiments were performed in a darkened room so that all extraneous clues to localization were eliminated. The phi phenomenon was used.

In the author's experiments the successive flashes of light were either homonymous or heteronymous. Homonymous flashes were described as those in which the light perceived by the left eye was on the left, and that perceived by the right eye was on the right. When successive flashes were homonymous and the first flash to the left and the second to the right, an orthophoric subject would state the light moved from left to right. Likewise, if the flashes were heteronymous (flash for left eye on the right and flash for the right eye at the left) an orthophoric subject would report the light moved from right to left.

Subjects with phorias and normal correspondence were also tested. It was assumed that they were in a dissociated position due to room darkness.

Exophoric subjects with normal correspondence correctly localized the light flashes except when stimulation was *homonymous* at an angle *less* than the subject's angle of deviation. (Diagrams drawn by the author indicate that incorrect localization is due to the fact that the first light flash is on the macula of the straight eye and the second on a templeward retinal area of the deviating eye, resulting in localization is due to the nasal side.)

Esophoric subjects with normal correspondence correctly localized the light flashes except when stimulation was *heteronymous* at an angle less than the subject's angle of deviation. (A diagram indicates this is due to stimulation of a nasal retinal area of the deviating eye and localization to the templeward side.)

Exotropias with abnormal correspondence localized the light flashes like esophoric subjects with normal correspondence. That is, they gave incorrect answers when stimulation was heteronymous at some small angle. The only difference between these exotropic and the normal esophoric subjects is that there was no exact angular distance at which the subjects with abnormal correspondence change from correct to incorrect localization. Instead, there was a varying response during repetition of the test. The author attributes this to existence of two separate, unconnected visual pathways from each eye to the cortex for localization.

4-1

Dedimos, P., and Calamandrei, G.: *Sur les troubles de la convergence: étiologie, pathogénie,* Arch. d'ophth., 11: 564-570, 1951.

The authors analyzed 117 cases of convergence insufficiency found among 6,000 private patients. They included patients who had both simple convergence insufficiency and far point exophoria combined with convergence insufficiency. Excluded were patients with refractive errors above one diopter, to eliminate the influence of the refractive error on the convergence anomaly. Also excluded were convergence insufficiencies associated with Basedow's disease, parkinsonism, syndrome of Millard-Gubler, encephalitis lethargica, brain tumors, paralysis of vertical gaze, third nerve paralysis and facial paralysis.

Among the included cases the authors divide the patients into two groups: those in whom the disability appeared slowly and became progressively worse, and those who were suddenly attacked.

In the group of patients who had a rapid onset of convergence insufficiency, two types of etiology were distinguished: convalescence from a serious illness which had been accompanied by fever, and onset during symptoms which suggested an infection of the spinal cord. Among the febrile infectious diseases which preceded a sudden onset were typhoid fever, paratyphus, spinal meningitis, grippe, "cerebral rheumatism," pneumonia, dengue, malaria, pleurisy and even intestinal intoxication.

In the group of patients with a slow onset were found a large number who were nervous, irritable, often depressed, and quite often anemic and weak. These two elements, nervousness and anemia, laid the groundwork for the appearance of convergence insufficiency. Secondary to the nervousness and anemia among many of these patients was a small anomaly of refraction. Often correction of these small anomalies was followed by rapid regeneration of convergence.

Convergence insufficiency was also found among patients with tuberculosis. Among 62 sanatorium patients, 12 were found with insufficiency of convergence. Following amelioration of the tuberculosis the convergence insufficiency lessened.

Toxic conditions were also found. Two patients had quinine poisoning accompanied by lesions of the optic nerve. Patients with toxic states due to overindulgence in tobacco or alcohol frequently improved their convergence with abstinence; insufficiency of convergence in diabetics was made worse or better according to the severity of the hyperglycemia. Other toxic states found were due to chronic nephrosis and lead poisoning.

Many cases with convergence insufficiency have nasal trouble characterized by hypertrophy of the turbinates. The frequency of this association leads the authors to suppose that the nasal affection provokes a relaxation of the neuromuscular tonus which enhances or even provokes the convergence insufficiency. This supposition was confirmed by favorable results obtained by resection of the turbinates.

The authors have observed secondary symptoms which often accompany the classic symptoms of insufficiency of convergence. These are (1) spasm of the central retinal artery, nearly always bilateral, which manifests itself as momentary "blackout" of vision both at near and far, and (2) spasm of accommodation, of short duration, accompanied by pseudomyopia. These symptoms are evidently parallel manifestations of a disturbance of the general nervous system.

The author states that many patients obtain partial relief from prisms of 2 to 4 diopters. No mention is made of the amount of exophoria relieved by these small prisms. They also mention achieving success in several cases by injections of vitamin B.

Prisms were not used to measure the amount of deviation. The authors classify a patient without convergence insufficiency as one who can converge so that the edge of both corneas is within 1 or 2 mm. of the lacrimal ducts and who can repeat the convergence without fatigue. There is no statistical summary of the etiologic causes of these cases but rather a generalized discussion.

6-1

Franklin, Dorothy A.: *Differentiation of phi phenomenon and parallax; the use of phi phenomenon in determination of retinal correspondence,* Am. J. Ophth., 34:77-83 (Jan.) 1951.

The author differentiates between the phi phenomenon and parallax as described in the current literature. She indicates that what has been generally termed the parallax test is actually the phi phenomenon. Phi phenomenon, under the name of parallax, is presumed to measure heterotropia. However, since the phi phenomenon, as elicited by the cover test, actually measures phoria and not tropia, this could lead to a possible misinterpretation of

results, as this test might be used to differentiate between phoria and tropia.

"Phi phenomenon is the sensation of movement which occurs when disparate retinal elements are stimulated." However, this movement occurs prior to the movement of the eyes as it takes up fixation when the cover is removed. The use of the test in measuring the phorias depends on the use of prisms to place both right and left images on the foveas until no movement of the light is noted. Therefore the prisms used to stop the apparent movement of the test object measure the degree and kind of phoria present.

She lists three advantages to the phi phenomenon test: (1) it approximates conditions of ordinary vision more exactly, (2) it shows minor degrees of inhibition and (3) it differentiates between a phoria and a tropia when of a small degree, the phi phenomenon being present in phoria and absent in squint.

Motion parallax and binocular parallax are described. Binocular parallax results from the lateral, separation of the two eyes, is proportional to the pupillary distance, and inversely proportional to the distance of the object of regard. Upon this depends the stereoscopic perception of depth.

6-2

Hewitt, Robert S.: *Torsional eye movements,* Am. J Ophth., 34:253-260 (Feb.) 1951.

Dr. Hewitt has tried to show the difference between torsion of the globe and oblique movements with the accompanying torsion. The results of a few simple experiments in examining torsional movements with the afterimage, astigmatic dial and the visual acuity method are reported.

7-1

Posner, Adolph, and Schlossman, Abraham: *Relation of diplopia to binocular vision in concomitant strabismus,* Arch. Ophth., 45:615-622 (June) 1951.

Postoperative diplopia of various types is discussed and classified by the authors as follows:

1. Diplopia occurring with normal retinal correspondence.
   - A. Cases in which the strabismus was undercorrected. This is often associated with hypertropia.
   - B. Cases in which the strabismus was overcorrected. This is usually the severest and most intractable type of diplopia.
2. Diplopia occurring in cases with abnormal retinal correspondence.
   - A. Mild paradoxial diplopia occurs frequently after operation and is usually self-limited.
   - B. Severe paradoxical diplopia and triplopia; this occurs in the presence of eccentric fixation of the squinting eye.

The authors present two cases, of ten which he has observed, of type 1 B. The first case illustrates postoperative diplopia in a convergent squint and the second is one of divergent squint.

From the ten cases observed it was found that diplopia occurred after surgical intervention. After correction, binocular vision involved areas of the retina which were not capable of suppression; that is, areas were being stimulated that had not previously been exposed to conditions necessitating suppression.

Some of the interesting phenomena such as retinal rivalry, ocular dominance, regional suppression and fusion are described.

With regard to central and peripheral vision the authors believe that peripheral vision is more a primitive function than the recently acquired central vision, more stable, and often remains intact even after suppression of the central area has developed. Peripheral fusion may help the patient to restore binocular single vision either with or without orthoptics or surgery. In these cases there may or may not be a coexistent facultative abnormal retinal correspondence.

11-1

Scobee, Richard G.: *Esotropia; incidence, etiology, and results of therapy,* Am. J. Ophth., 34:817-833 (June) 1951.

Dr. Scobee writes on the incidence, etiology and results of therapy in a study of 558 cases of heterotropia, 456 of which were cases with esotropia.

The methods employed by Dr. Scobee in this study are listed in detail. It was possible to give adequate treatment and secure an accurate follow-up on 238 patients. All forms of therapy with the exception of formal orthoptics were given, and 56.7 per cent attained fusion. At the time this study was made, no formal orthoptics was available. Another study will follow in which orthoptics was used.

Almost 28 per cent of 524 patients with heterotropia had the deviation present at birth; 13.5 per cent with esotropia were born prematurely (31 prematures out of 230); 28 per cent with esotropia (90 out of 321) were delivered with obstetrical forceps, and 41 per cent with esotropia had others in the family with the same condition.

Of the 456 patients, 86 (19 per cent) were nonaccommodative; 303 (66 per cent were partly accommodative, and 67 (15 per cent) were purely accommodative.

The average refractive error for the nonaccommodative group was plus 1.18 diopters; for the partly accommodative, plus 3.30 diopters, and for the purely accommodative, plus 4.01 diopters. The incidence of anisometropia was about the same in all three groups.

The result of occlusion for suppresion amblyopia suggest that there is no particular relationship between either the age of onset of esotropia or the duration of esotropia and the level of amblyopia developed in the deviating eye. The data seemed to prove that with occlusion, visual acuity was considerably improved even in an eye crossed from birth; 69 per cent of 91 patients obtained visual acuity of 20/40 or better.

One hundred ninety-five (43 per cent) of 457 patients with esotropia had a vertical component; 49 per cent of the nonaccommodative group; 45 per cent of the partly accommodative and 21 per cent of the purely accommodative had a vertical component. The superior rectus was more frequently paretic than any other vertically acting muscle.

Of 171 patients who had surgery, 46.5 per cent with no vertical component attained fusion, while only 23.6 per cent with a vertical component attained fusion. In the partly accommodative group a vertical component made little difference. In the nonaccommodative group 36.8 per cent without a vertical component attained fusion, but only 18.1 per cent with a vertical component did so.

Significant anatomic anomalies were found with the muscle deviations in 88 cases (51.4 per cent); 90 per cent of nonaccommodatives had anomalies which probably were responsible for the deviation; 43.1 per cent of the partly accommodative cases had anomalies which may have resulted in a predisposition toward the development of an esotropia, a predisposition which became an actual deviation with the addition of the accommodative element.

15-1

Colson, Z. William: *Verhoeff's theory of normal binocular vision; an elementary introduction,* Am. J. Ophth., 34:200-204 (Feb.) 1951.

The author presents the principles and experiments explaining Dr. Verhoeff's theory of binocular single vision and stereopsis. He raises the question of whether the usually accepted theory (that fusion of two slightly disparate images forms the basis of stereoscopic vision) is entirely correct. Dr. Verhoeff's original article was published in the *Archives of Ophthalmology,* February 1935.

15-2

Winkelman, J. E.: *Peripheral fusion,* Arch. Ophth., 45:425-430 (April) 1951.

Dr. Winkelman describes the method by which he arrived at the concept of peripheral fusion. Although his method was completely different, he confirms Dr. Burian's previous contentions, that identical objects imaged on peripheral disparate points of the retina can induce a fusional movement of the eyes which brings on corresponding points, and that the peripheral fusion may even be so strong as to break the fusion of images situated on the macular region. The stimulation exerted by the peripheral images depends on the size and brightness of these images and on the distance from the fovea. In addition, Dr. Winkleman found that the time of exposure of the peripheral stimulus played a significant role.

17-1

Abraham, Samuel V.: *The nature of heterophorias,* Am. J. Ophth., 34: 1007-1016 (July) 1951.

Dr. Abraham discusses the primary position of rest, stressing the relation of phoria to strabismus and to the "position of rest." The data shows that we have no real evidence for assuming that the phoria present will determine the type of strabismus to be expected, if it should occur at any age.

Instead of dividing convergence activity into that part controlled by the fusion faculty and that part controlled by the accommodation, as suggested by Stutterheim, Duke-Elder, and others, the author feels it would be better to divide this function into two closely related types, separated clinically into the voluntary and involuntary form. This fits into the story of the development of convergence, which is discussed at length.

The author, after examining many thousands of cases, found that the cases could be divided into three major groups, which help to explain

the clinical complaints: (1) patients with normal convergence, (2) patients with subnormal convergence, and (3) those with abnormal convergence. These are discussed in full with average figures for each group.

17-2

Scobee, Richard G., and Green, Earl L.: *Further studies in the relationship between heterophoria and prism vergence,* Am. J. Ophth., 34:401-404 (March) 1951.

It was found with this further study that the relationship between heterophoria and prism vergences was of clinical value. The convergence-divergence ratio being worked out both for apparent or manifest vergences and true vergences can be of aid in treating patients with the same symptoms and findings. With 12 diopters of divergence, glasses may be of help, while less than 12 diopters will require more than glasses, sometimes surgery. It was found that a patient must have 12 diopters of apparent or manifest divergence at 13 inches if he is to work comfortably at that distance.

21-1

Brumback, Joseph E., Jr.: *Fixation-light holder modifications; for screen and cover test in cardinal positions for near,* Am. J. Ophth., 34:897-898 (June) 1951.

Modifications of the commercial fixation-light holder, used for screen and cover test in cardinal positions for near, are presented.

21-2

King, J. H., Jr., and Forrest, R. L.: *A modified strabismus muscle forceps,* Arch. Ophth., 46:155-156 (Aug.) 1951.

This article deals with the modification of the Jameson and Prince recession forceps and its aid in lessening the danger of damaging the eye in muscle surgery.

21-3

Krimsky, Emanuel: *The stepladder prism,* Am. J. Ophth., 34:1031-1033 (July) 1951.

The stepladder prism differs from the familiar prism rack in that it is of graded strength and is limited to the size of a standard square prism (38 mm. square). Because of its small size, each step or strength of the ladder is made relatively small, but adequate for diagnostic or training requirements. Also because of its small size, the stepladder prism can be used either horizontally or vertically. Another advantage is that it may be inserted in a prism holder which the patient can hold, leaving both hands of the examiner free for holding the flashlight and cover. These can be made in different desired strengths or combinations.

21-4

Krimsky, Emanuel: *A combination square prism and lollipop holder,* Arch. Ophth., 46:337-338 (Sept.) 1951.

This new prism holder makes it possible for the patient to hold the prism in the correct manner and leaves the examiner's hands free to hold a flashlight and rotary prism. The holder is inserted in such a way that the prism can be turned base in, base out, base up or down.

21-5

McBride, J. P.: *Red-green test in diagnosis of eye muscle anomalies,* Am. J. Ophth., 34:1033-1035 (July) 1951.

The author compares the first red-green test described in 1912 by Dr. W. R. Hess with the Lancaster test (1939), using the same principles but in many ways an improvement over the Hess method. The method for doing the test and an explanation of the interpretation is given in detail.

21-6

Putman, Otto A., and Quereau, J. Van Dyke: *The tropophorometer: an instrument employing a new system of coordinates for more accurate measurements of heterophoria and heterotropia,* Arch. Ophth., 45:186-193 (Feb.) 1951.

The authors write further on the tropophorometer, an instrument which has been devised for the purpose of permitting accurate measurements of extraocular muscle anomalies in the six cardinal directions by any of the methods in which a heterotropia or heterophoria is usually measured. Recent improvements include a direct reading feature which speeds up the examination.

21-7

Sloane, Albert E.: *Analysis of methods for measuring diplopia fields: introduction of device for such measurements,* Arch. Ophth., 46:277-310 (Sept.) 1951.

It is to the interest of every orthoptic technician to know and understand the diplopia field. Dr Sloane's article is of great use. It is of great importance to have ease in carrying out the test, to be quick and efficient, and to make the patient comprehend the test itself. Therefore the simplest and most efficient method should be used.

There are stated in this article the various methods used for diplopia fields starting from 1876. It is interesting to see how the method has developed. Best known and most widely used is that of Lancaster. Sloane's new device, or the one he has been using and finds very efficient, is very similar to one described by Krusius in 1908. It consists of a small measuring board 18 by 12 inches and is made of a transparent piece of plastic material. Mounted on a light handle it has a small central bulb and a Maddox cross. The examiner holds the screen at 20 inches and holds a red glass in front of the patient's eye. The patient, using the end of a pencil, indicates where the red light is seen. The patient's head can be moved to any position desired and the test repeated.

Maddox' method of measuring the angle of squint, another accurate way of measuring diplopia, is explained in detail.

The prism and cover test also measure the amount of deviation, but in order to use the test accurately White recommends the following requisites: (1) central fixation must be present, (2) there must be sufficient light for eyes to be seen but not too much to annoy the patient, (3) screen or cover must be large enough to cover the eye without distracting the attention of the patient, and (4) the cover must be moved slowly enough for the eye being uncovered to regain fixation.

22-1

Allen, James H., ed.: *Strabismus ophthalmic symposium,* St. Louis, C. V. Mosby Co., 1950, as reviewed in Arch. Ophth., 46:110-111 (July) 1951.

This is the first volume of its kind to be published. It is the transactions of the strabismus symposium held at the University of Iowa with Dr. James H. Allen, who has edited the book, as moderator. The country's foremost authorities on this subject have joined their forces and produced a truly useful and interesting book.

22-2

Drucker, Arnold P., and Cazort, Ralph J.: *Clinical trial of a new atropinelike drug: the use in ophthalmology of alpha, alpha-diphenyl-gamma-dimethylaminovaleramide (BL 139), a synthetic drug with atropinelike action,* Am. J. Ophth., 34:847 (June) 1951.

BL 139 is a synthetic compound with marked atropine-like action. The effects of this drug were compared with those of atropine and it was found capable of producing mydriasis and cycloplegia both on local application and after oral administration.

The drug was tested clinically on more than 57 normal eyes and 63 eyes showing pathologic conditions.

A 0.5 per cent solution produced cycloplegia comparable with that due to 5.0 per cent atropine solution. A 2.0 per cent BL 139 ointment was found equivalent to 1.0 per cent atropine ointment both for refraction and for therapeutic use.

Preoperative use of a 1.0 per cent solution of BL 139, when combined with the use of a 10.0 per cent neosynephrine, resulted in sustained maximal dilation of the pupil. Pilocarpine and eserine were found ineffective when used following BL 139 administration.

Primary glaucoma was precipitated or aggravated by the use of the drug.

None of the 12 patients sensitive to atropine showed untoward response to the new drug and all have benefited from its use.

22-3

Ogle, Kenneth N.: *Optics and visual physiology: Review of literature for 1949 and 1950,* Arch. Ophth., 45:684-703 (June) 1951.

Dr. Ogle reviews the recent literature on such topics as spherical aberration of the eye and its effect in connection with the cause of night blindness, ametropia, aniseikonia, and the value of the contact lens in order to obtain a high magnification of the retinal image in the case of subnormal vision. Visual acuity, ocular functions, binocular coordination, prism (fusion) vergences, stereopsis and several other subjects are covered, making interesting and enlightening reading for both ophthalmologist and orthoptic technician.

22-4

Peckham, R. H., and Harley, R. D.: *The effect of sunglasses in protecting retinal sensitivity*, Am. J. Ophth., 34: 1499-1507 (Nov.) 1951.

Research was conducted, with the cooperation of life guards at Atlantic City, N. J., of the protection afforded from excessive sunlight at the beach by sunglasses of varying densities. Sunglasses of commercial density (35 to 50 per cent) will supply some protection for short periods, say one day or less, but not for a week or more. Darker sunglasses (10 to 12 per cent) will provide protection for periods as long as a week or more. These glasses are commercially available but are in the minority. Failure to wear glasses will result in loss of retinal sensitivity on an average of 50 per cent or, in extreme cases, 90 per cent. Subsequent dark adaptation is delayed for a period of days or weeks after such exposure. This can be of particular danger in night driving and certain types of work. As a pragmatic test, if the wearer's eye can be seen behind the lenses, the lenses are probably not dark enough.

22-5

Walls, Gordon L.: *A theory of ocular dominance*, Arch. Ophth., 45:387-412 (April) 1951.

Brainedness is found to be the primary determinant in the selection of one member of any bilateral pair of structures in the body, with the exception of the eyes. The real basis of an ocular dominance may be sensory, although its obvious manifestations are motor. considering the asymmetrical visual and ocular phenomena which have been advanced as criteria of the sidedness of dominance, Dr. Walls has compiled a noteworthy list divided into five groups.

Group I phenomena are asymmetries in which there is no oculomotor element; for example, the dominant eye is the one whose image in a rivalry situation is in consciousness for more of the time than that of the other eye.

Group II phenomena. The general character of this group is motor and one recognizes the familar laterality expressed by such terms as "dominant eye" and "master eye"; for example, the eye with which one aligns a finger or pencil in pointing at another object when both eyes are open.

Group III phenomena are not really separable from those of Group II, but are perhaps a little more easily seen to be secondary consequences of a dependence on one eye for the establishment of direction. The eye "nondominant" in this regard has so little responsibility that no harm is done if it deviates from the point of regard, for, according to Dr. Walls' hypothesis, the direction in which that point is seen to lie is wholly determined by the dominant eye. The system as a whole is indifferent to the motor behavior of the nondominant eye just so long as it does not wander so far as to give rise to diplopia. For example, the eye which with bifixation at 20 feet deviates less if covered, or the eye which continues to fixate a target pushed up within the convergence near point.

Group IV phenomena. In this group the dominance of the directionalizing eye asserts itself as the "master" eye: it behaves as if it were lazy, as if it were disinclined to leave the primary position and were trying to insist that the "servant" eye do all of the vergences necessary to secure and maintain haplopia. For example, the eye before which one holds a card to read it.

Group V phenomena are, in Dr. Walls' opinion, perhaps all meaningless. An example is the eye on the side of the dominant hand.

In connection with the visual perception of space, localization is all-important. Two elements make up the position or locality of a visual point or object: its direction and its distance. It is hypothesized that motor ocular dominance consists in the employment of the patterns of innervation sent to the rotary muscles of one eye only, for the establishment of the perceived egocentric directions of visual objects in either binocular or monocular vision. It is further suggested that in voluntary eye movements, voluntary innervation may normally go to the muscle of the directionally dominant eye only, the other eye being caused to "track" by constellation of well-known reflexes and synkineses.

Some nonclinical and clinical implications of the theory of directional dominance are outlined and discussed, such as the practice of putting prismatic corrections exclusively in the lens before the nondominant eye, and the practice of placing Maddox rods and similar devices only in front of the nondominant eye in diagnostic procedures. The theory does not imply any necessary relation between the extent of heterophoria and the "strength" of dominance.

Several subsidiary problems, raised by the theory, are pointed out, the solutions of which would afford further tests of the validity of the theory.

24-1

Burian, Hermann M.: *Scope and limitations of orthoptics in nonsurgical treatment of ocular deviations,* Arch. Ophth., 45:377-381 (April) 1951.

Before giving the scope and limitations of orthoptics in the treatment of squint, Dr. Burian remarks that the general principles governing the treatment of the neuromuscular anomalies of the eyes are surgical, nonsurgical and, in some cases, a combination of both. Surgery has a direct effect only on the mechanical conditions and is the only means by which a permanent change in the relative position of the eyes can be achieved. Innervational conditions are affected only indirectly, so far as these adjust themselves postoperatively to the changed mechanical situation. Nonsurgical means can never achieve a permanent change in the relative position of the eyes but can affect and normalize the innervational conditions. The field of orthoptics comes under the province of the latter method of treatment. In the broadest sense of the word, every form of nonsurgical treatment of neuromuscular anomalies of the eyes is orthoptic therapy and in this broadest sense could be considered to include the prescription of glasses for the normalization of the convergence accommodation relationship.

In considering the scope and limitations of orthoptics then, one may expect orthoptic treatment to do away with certain faults in the monocular and binocular visual act. Orthoptic treatment can never create anything new in the visual act, but can improve or normalize the elements necessary for normal monocular and binocular vision; it can correct pathologic exaggerations or pathologic deficiencies of these elements, such as improving central fixation and the visual acuity of amblyopic eyes; it can combat suppression, and can, in appropriate cases, remove abnormal retinal correspondence. When these visual faults have been done away with, orthoptic treatment may then be expected to encourage proper visual habits and to train those visuomotor functions which are trainable, such as teaching the patient how to dissociate accommodation from convergence. Fusional amplitudes may be increased and improved. When necessary, the near point of convergence may be improved and last, but not least, orthoptic exercises may be expected to give comfortable binocular vision to patients with heterophoria who display symptoms.

It is recognized that orthoptic training cannot change the angle of squint permanently, but it can achieve a change in the angle of squint by transforming a manifest into a latent strabismus. The strabismus, however, will remain only as long as the conditions last which were created by the orthoptic training, otherwise the manifest deviation will return. Orthoptic exercises are powerless where a mechanical or paralytic condition is the underlying cause of the strabismus. Again, it is impossible to compel someone to fuse who is incapable of fusing, just as it is impossible to compel one to perceive depth who cannot see stereoscopically, but the orthoptist can encourage fusion by offering optimal stimulus conditions to make fusion possible. Also, the point is made that some definitely nonorthoptic cases can benefit from orthoptic treatment, when such treatment is judiciously applied. Preoperative orthoptic treatment is much more likely to insure a functional cure following operation than when surgical treatment alone is employed.

It must be remembered that when considering the institution of orthoptic treatment, it is necessary to give individual consideration to every case in all its aspects--ophthalmologic social, medical and educational. Dr. Burian feels that a really clear recognition of the facts relating to the scope and limitations of orthoptics would provide for a happier and more wide-spread co-operation between orthoptic technicians and ophthalmologists.

24-2

Burian, Hermann M.: *Strabismus,* Arch. Ophth., 46:73-93 (July) 1951.

This article of Dr. Burian's is a review, attempting to cover the literature on strabismus, for the year of 1950. Under etiology and symptomatology, Dr. Burian shows the different causes or possibilities of strabismus as discussed by other doctors: (1) refractive errors, (2) cortical defects, (3) secondary muscular changes (Piper), (4) supranuclear lesions, (5) psychogenic causes and (6) amblyopia exanopsia.

During the past year anomalous retinal correspondence has received a great deal of attention. Stephenson states that the following factors have little or no influence in the development of anomalous retinal correspondence: (1) amount of the angle of squirt, (2) refractive errors, (3) visual acuity, (4) heredity and (5) the accommodative element.

In this particular section of the report there are many figures given for the patients observed by different doctors and technicians. They show the percentages of patients with harmonious retinal correspondence, unharmonious retinal correspondence and the types of

squints. The binocular phi phenomenon is discussed in relation to the determination of the status of retinal correspondence.

Dr. Costenbader feels that an abnormal convergence innervation is the predominant cause of the misalignment of the visual axes in convergent esotropia. He goes on to suggest a classification of concomitant esotropia.

Part two of Dr. Burian's paper is the nonsurgical treatment, or orthoptic training, for strabismus. Orthoptics treatment is receiving more and more attention in the treatment of strabismus. The first step is to correct refractive errors at the earliest age possible. Occlusion, if necessary, is next, and while the patient is under total occlusion planned exercises should be started. Some advocate immediate surgery after training and immediate training after surgery. Many cases are considered, both those receiving only orthoptic training and those receiving training and surgery.

Part three of Dr. Burian's paper deals with surgical treatment. This entire section states the different opinions in operative procedures. There is a wealth of information to be found by those reading it.

24-3

Lyle, T. Keith: *The present position of orthoptics in treatment of manifest and latent strabismus,* Tr. Ophth. Soc. U. Kingdom, 70:19-20, 1950.

Orthoptic treatment is not essentially a method of curing squint but a means of stimulating and re-educating binocular vision. In many cases surgical treatment is indicated. Correct refraction and use of occlusion is of first importance, to be followed by orthoptics in selected cases if the patient is of sufficient mental development to cooperate.

Orthoptic treatment is used to eliminate anomalies of binocular vision such as suppression and abnormal retinal correspondence when they exist, to awaken fusion and develop fusional reserve and stereoscopic vision.

An orthoptic department is concerned with (a) assessment of visual acuity in young children by means of the "E" test; (b) direction and supervision of occlusion to equalize vision of the two eyes; (c) preoperative and postoperative orthoptic exercises in appropriate cases of squint in which restoration of binocular vision is envisaged; (d) cure of certain cases of accommodative concomitant convergent strabismus; (e) cure of certain cases of decompensated heterophoria and (f) cure of most cases of convergence insufficiency.

In the case of children it is urged that they should be brought for advice as soon as the squint is noticed. At present much time is spent in orthoptic departments trying to eradicate abnormalities of binocular vision which have been allowed to develop due to neglect. Early diagnosis and treatment are essential in all cases.

25-1

Chamlin, Max, and Davidoff, Leo M.: *Divergence paralysis with increased intracranial pressure; further observations,* Arch. Ophth., 45:145 (Aug.) 1951.

The authors report on further observations of two cases of divergence paralysis with increased intracranial pressure. A summary of a previous paper is presented. Divergence paralysis is described in the following conditions: (1) inflammatory and toxic disease of the cerebrum; (2) cerebral hemorrhage; (3) brain tumor; and (4) head trauma.

From the total of 15 cases observed, the diagnosis of increased intracranial pressure and divergence paralysis was confirmed either at operation or at necropsy. In 8 of the cases a focal lesion was present in the posterior fossa, and in 7 there was not. The only common factor in these cases of divergence paralysis was increased intracranial pressure. Ten of the 15 cases showed definite improvement following relief of intracranial pressure.

The authors are inclined to argue against, rather than for, the existence of a divergence center.

25-2

Lyle, T. Keith, and Cross, Alex. G.: *Diagnosis and management of paralysis of the extrinsic ocular muscles, with special reference to surgical treatment in 219 cases.* Brit. J. Ophth., 35:511-548 (Sept.) 1951.

This is a most interesting review of the clinical investigation, etiology, and treatment of 219 of the authors' cases of paralytic strabismus. Many tables and detailed results of operations are given which cannot be abstracted but for which reference should be made to the original article.

Of 219 cases of paralysis of extraocular muscles treated surgically, 47.5 per cent were congenital, 46.5 per cent traumatic, 3.5 per cent due to known organic disease, and 2.5 per cent due to disease of indeterminate origin. Of the 46.5 per cent cases of traumatic origin 28.5

per cent were cerebral injuries and 18.0 per cent orbital.

The muscles most frequently involved were the superior oblique in 39.5 per cent of cases, and the superior rectus in 31.0 per cent. Next in order of frequency were the lateral rectus, 12.0 per cent; inferior oblique, 6.0 per cent; inferior rectus, 4.5 per cent; medial rectus, 2.5 per cent; muscles of Nerve III, 1.5 per cent; muscles of Nerves III and IV, 0.5 per cent; and mixed (2 muscles), 2.5 per cent.

The authors mention the following sequelae of the original palsy which were found upon examination: (1) overaction of the contralateral synergist, (2) contracture of the direct antagonist, and (3) secondary palsy of the contralateral antagonist.

The clinical examination included a detailed history. Diplopia, either in all directions or only in certain directions, was the most common symptom. Tests of muscle activity and fusion included: (1) the cover test, (2) the Maddox rod test at 6 meters, using the rod in front of each eye to determine the primary and secondary deviations, (3) the Hess screen or Lancaster red-green test, and (4) the major amblyoscope. The Hess screen demonstrates the muscle or muscles involved, and the amblyoscope gives the status of binocularity, the presence of suppression, and fusion vergence power.

In addition to the ocular tests, other clinical tests were employed, including urinalysis, Wassermann blood test, roentgenograms of the skull and orbit, lumbar puncture, encephalography, ventriculograms and arteriography, as indicated.

Preoperative treatment included the stimulation of binocular vision by orthoptic methods. If the visual axes are made approximately parallel, a more rapid resumption of normal binocularity will occur if binocular functions have been exercised than if some degree of suppression has occurred.

Sometimes temporary prisms were used to aid fusion until operation was performed. Surgery was done when it appeared that no future improvement in the paralysis could be expected, and when it appeared that any etiologic disease was no longer active.

Operative principles were discussed. Only a brief digest will be given of the very detailed tables which show preoperative and postoperative measurements, history, millimeters of recession and resection, etc.

Superior oblique paralysis. In congenital cases, updrift of the paralyzed eye is usually marked and inferior oblique myectomy in most cases gives excellent results. In other cases, if vertical deviation in the primary position is large, it is usually wiser to start by recessing the contralateral inferior rectus and later, by performing myectomy of the ipsilateral inferior oblique, if necesary.

Superior rectus paralysis. Partial myectomy of the contralateral inferior oblique is most frequently done. It is best to aim in surgery for orthophoria in depression. If orthophoria in the primary position is attained, there may be distressing diplopia looking down.

Lateral rectus paralysis. Recess the contralateral synergist or the direct antagonist, resect the affected muscle or the contralateral antagonist, or do a combination of these procedures.

Inferior oblique paralysis. The opposite superior rectus should be recessed or have a marginal myotomy.

Inferior rectus. Miscellaneous procedures were used.

Medial rectus. Tenotomy or recession of the lateral rectus of the opposite or same eye was done.

Improvement was shown in almost all of the cases operated upon, with orthophoria in many. The authors believe that there is too great a tendency in ophthalmology to deny the benefit of surgical intervention to these patients. They state that many of them can be helped materially, and that with careful diagnosis, orthophoria can be achieved for many in the primary position, and binocularity in most of the field of vision.

26-1

Cook, Raymond C., and Glasscock, R. E.: *Refraction and ocular findings in the newborn,* Am. J. Ophth., 34:1407-1413 (Oct.) 1951.

One thousand eyes were studied under atropine cycloplegia; of these 74.9 per cent had hyperopia ranging from less than 1 diopter to 12 diopters; 50 per cent had less than 3 diopters of hyperopia, and 25.1 per cent had myopia ranging from 1 diopter to 12 diopters. Of this group 88 per cent took less than 4 diopters of correction. Astigmatism was present in 38.8 per cent of the hyperopic eyes and 27.3 per cent of the myopic eyes, while 4.8 per cent of the eyes had retinal hemorrhages of unknown cause usually located in or near the macular area. This may account for certain unexplained amblyopias or macular degenerations of childhood.

26-2

Cowan, Alfred: *Emmetropia,* Am. J. Ophth., 34:1021-1024 (July) 1951.

The refraction of an eye depends on two or more of the following: (a) the curvature of the cornea; (b) the distance from the cornea to the crystalline lens, that is the thickness of the meniscus which is the corneal system; (c) the dioptric power of the crystalline lens; (d) the indices of refraction of the optical media of the eye; (e) the distance of the fovea from the dioptric system, or the length of the eyeball.

In the static eye the reciprocal of the distance of the punctum remotum or far point from the anterior principal point (R) is the measure of the refraction (r) of the eye. r=1/R.

When the far point of an eye during repose (a static eye) lies at infinity and R can be replaced by the symbol ∞ in the formula the refraction would be expressed by $1/\infty = 0$. The refraction is zero. The eye is emmetropic.

The emmetropic eye is the standard—the zero eye—in which the position of the fovea coincides with the posterior principal focus of the dioptric system.

The emmetropic eye is not necessarily of a certain length or constant power and is not to be confused with a schematic eye, which may or may not be emmetropic. It does not need to be a healthy eye; it may even be blind. The visual acuity need not be normal.

The term emmetropia is applied to one eye; it is not concerned with binocular coordination.

Data and figures are given showing how a slight difference in length of the eyeball or a change in the radius of curvature of the cornea produces a change in refraction.

Clinically, an eye is usually called emmetropic when, under cycloplegia, the visual acuity cannot be improved by any lens. The author then mentions certain allowances that must be made.

While emmetropia is the mathematically exact refraction of the eye, it is not necessarily the most desirable. Since the eyeball grows during childhood and through adolescence, hypermetropia in children is preferable to emmetropia.

"Emmetropia is a necessary and most useful term in the classification of anomalies of refraction. It indicates the zero refraction, the line from which ametropia can be measured on either side."

26-3

Pendse, G. S., Dan De Kar, V. M., and Bhave, L. S.: *Preliminary note on study of the refractive state, with special reference to myopia,* Arch. Ophth., 45:168 (Feb.) 1951.

A study of refraction was undertaken in a fairly homogeneous group under the auspices of the Indian Council of Medical Research. The ages of the first group of subjects ranged from 6 to 12 years. The data are based on the examination of a sample of 590 unselected school children and the heights, weights, and blood pictures were studied where possible.

The mean refraction was shown to be + 1.0 D., the mode + 1.25 D., and the standard deviation + 1.0 D. The variation of refraction showed a downward trend with age. The average refraction at 7 years was + 1.5 D. and at 13 years was + 0.5 D.

The relation of height to refraction showed a higher refraction with shorter people. Persons of subnormal heights are shown to have a higher, (more hypermetropic) refraction than taller people. In a small series of subjects with pathologic myopia the same observation was established. The heights of these myopes are greater than the average for their age. The actual weights here were lower than the average.

Blood pictures seem to show a difference in values for serum calcium between pathologic subjects and others.

The authors conclude from the present evidence the factor of nutrition is secondary to bodily growth in the development of pathologic myopia.

26-4

Schlossman, Abraham: *Refraction for binocular comfort,* Eye, Ear, Nose & Throat Monthly, 30:533-536 (Oct.) 1951.

The author feels that the ophthalmologist can achieve the best results in refraction if he properly balances the objective and subjective technics. In this way the patient will receive the greatest amount of binocular comfort with the best vision.

A good refractionist should be so familiar with all the technics of refraction that he can use the one that best suits the immediate situation. The author believes that the best objective method available is the streak retinoscope, as it can be used with children and patients with language difficulties. He explains the technics of fogging and cross cylinder,

Duochrome test, binocular manifest refraction, and the use of spherical equivalent for patients who wear cylindrical correction with part or alltime wearing of glasses.

A child with concomitant convergent strabismus is usually given his full atropine correction, but if he will not accept the full correction then he should be given less plus than was measured under atropine and it should be the maximum correction that he will wear comfortably.

28-1

Chandler, Paul A.: *Practical considerations concerning choice of operation in convergent squint,* Am. J. Ophth., 34:375-381 (March) 1951.

A correct analysis of overacting or underacting muscles plays an important role in the choice of surgery. Equally important are the preliminary factors such as the determination of an alternating or monocular squint, the presence of amblyopia, and the refractive error.

Surgery is usually done on the squinting eye in monocular squint. A recession of the internal rectus, a resection of the external, or a combination of the two may be done. The internal rectus should be recessed if the near point of convergence is unlimited. If on the other hand the patient has a remote near point of convergence a resection of one or both external rectus muscles should be done.

The effect of the recession should be relatively greater if the following points are found: (1) the angle of deviation is greater for near than for distance; (2) the presence of a considerable accommodative element and (3) the muscle is found to be strong or abnormal check ligaments are found.

In alternating squint the following factors should be considered before surgery is attempted:

1. Patients with a hypermetropia of one diopter or more should be given a trial with glasses for at least a few months.

2. The near point of convergence is taken and if found to be unlimited with both eyes open, the test is repeated covering one eye and then repeated with the other eye covered. The examiner observes the screened eye, if the eye under cover ceases to converge at a greater distance from the root of the nose than does the other eye under cover, this may indicate that one medial rectus is stronger than the other though dominance may affect the result in some cases.

3. Whether or not the squint is greater fixing with one eye than the other.

4. The presence or absence of limitation of abduction and comparative abduction power of the lateral rectus muscles. The rotations are tested binocularly and monocularly. If lateral excursions are full but nystagmoid movements occur it may indicate a weak lateral rectus muscle.

5. The angle is determined by prism and cover test for distance and near.

6. Presence or absence of a vertical component.

7. Changes of fixation in various positions of gaze.

From an analysis based on these points alternating squint is divided into four general groups. The author describes each group thoroughly.

1. Those with an apparent overaction of the medial recti. The majority of alternating convergent squints fall in this group.

2. Underaction of the lateral recti with little or no secondary contracture of the medial recti.

3. Underaction of the lateral recti with contracture of the medial recti.

4. Overaction of the medial recti combined with underaction of the lateral recti.

28-3

Gibson, Glen Gregory: *Surgical principles of concomitant strabismus,* Am. J. Ophth., 34:1431-1437 (Oct.) 1951.

A plea for a systematic plan for muscle surgery in which the patients are divided into two groups depending on their sensory possibilities is made. The choice of muscles, the time of operation and the kind of operation are selected on the basis of the sensory possibilities with a plea for early surgery in most instances.

Symmetrical surgery is indicated for symmetrical findings and unilateral surgery for unilateral findings. The time of surgery is based on the principles of reflex development in childhood, age of onset, and duration of squint. Selection of various types of procedures is secondary to importance of selecting the proper muscle, time, and amount of operative correction. Marginal myotomy and graduated amounts of operative treatments are discussed. High hyperopia and a remote near point of convergence are signals for conservatism. Excessive action of internal recti or presence of muscular contracture indicates need for more than the average amount of cor-

rection. Amblyopia and anomalous retinal correspondence present additional problems.

Review of cases found 80 per cent cosmetic cures in all cases, 30 per cent functional cures in the early cases, and 10 per cent functional cures in the late cases. The final position was dependent on sensory development before onset of the deviation and length of time the deviation was present.

28-4

Steiner, Albert A.: *Traumatic disinsertion of the inferior rectus muscle,* Am. J. Ophth., 34:100 (Jan.) 1951.

A brief review of the rare condition of traumatic disinsertion of the inferior rectus is given. An interesting case in which the above condition existed for eight years is reported. Binocular single vision was restored with surgery and immediate postoperative biweekly orthoptic training.

28-5

Stine, George T.: *The surgical treatment of esophoria,* Am. J. Ophth., 34:1307-1313 (Sept.) 1951.

The author presents the results of the surgical treatment of 15 cases of esophoria, (ranging in age from 7 to 48 years) with symptoms not relieved by ordinary methods. Eight patients were male and seven were female.

Prior to operation the average esophoria was 15.5 prism diopters at 20 feet and 18.6 prism diopters at 13 inches. Two of the patients had intermittent esotropia.

In all but one case a full recession of one medial rectus muscle under general anesthesia was done. One case had both medial recti recessed, but interestingly enough was not overcorrected. Of the 15 cases reported, there was only one case of overcorrection and that one not too serious.

It seems significant that in 10 of the cases (66 per cent) there were anatomic anomalies varying from a thickening of the intermuscular membrane to secondary foot-plate type of insertions and many heavy check ligaments.

The average amount of correction obtained was 13.6 prism diopters at 20 feet and 16.1 prism diopters at 13 inches. The above results "are quite similar to results reported when exophoria is treated by bilateral recession of the lateral recti; that is, that the amount of the correction is proportional to the amount of the original deviation" not to the amount of surgery. This was demonstrated by Scobee and means, if carried to its extreme, that if two patients are seen, one with 20 prism diopters of esophoria and one with 10 prism diopters, and the same operation is done on both, the results would be that both would be orthophoric. At least the general principle seems to be true, even though this ideal condition is not always realized.

The results were most gratifying and all but two patients were asymptomatic.

The author summarizes the whole theory by saying that "esotropia is a result of hypertonicity of the convergence center frequently encouraged by anomalies of the medial rectus muscles, and that this condition can be corrected by removing the anatomic defects and decreasing the effective force of the medial rectus muscle by changing its insertion."

30-1

Green, Earl L., and Scobee, Richard G.: *Position of the Risley prism in the Maddox-rod test,* Am. J. Ophth., 34: 211-217 (Feb.) 1951.

A study to try to determine if a standard of testing a case of heterophoria is necessary in order to evaluate it more accurately. Cases were measured by two methods, so each case was a check on itself.

1. Maddox rod and Risley prism before the right eye.

2. Maddox rod before the right eye and Risley prism before the left eye.

A group of 51 patients were tested and it was found that the method made little difference in the measurement of lateral heterophoria, either at 20 feet or 13 inches. The vertical measurements did show a difference, thus indicating that a standard test is needed when a group of ophthalmologists are examining.

30-2

Kadesky, David: *A linear light target for diplopia field tests,* Am. J. Ophth., 34:756-757 (May) 1951.

The author feels that this light has distinct advantages over a point source of light.

1. A small amount of diplopia which might be interpreted as a blur with a point source of light will show as true diplopia with a linear light test object.

2. By changing the axis of a linear light source, discrimination of vertical and horizontal deviations is facilitated.

3. The presence of torsion of a linear image will immediately be apparent.

It may also be used with the red-glass test for plotting routine diplopia fields or with the Maddox double prism if torsional defects are suspected.

The light consists of a pocket flashlight equipped with No. 222 Mazda condensing globe and a lucite rod encased in a metal tube. This instrument is made by the Parsons Optical Laboratories, Inc., San Francisco, Calif.

30-3

Sloan, Louise L., and Rowland, William M.: *Comparison of ortho-rater and sight-screener tests of heterophoria with standard clinical tests,* Am. J. Ophth., 34:1363-1375 (Oct.) 1951.

This paper is part of a study of the reliability and validity of measures of visual functions provided by instruments such as the ortho-rater and sight-screener, and evaluates these tests in so far as they determine fitness for a particular occupation. A description of the tests is given, and the procedure outlined. A statistical analysis of the results is also presented.

30-4

Brockhurst, Robert J., and Lion, Kurt S.: *Analysis of ocular movements by means of an electrical method,* Arch. Ophth., 46:311-314 (Sept.) 1951.

The article explained the way of recording ocular movements by means of an electrical method. Two very interesting facts are that (1) preceding each eye movement is found a short movement in the reverse direction and (2) movements from the center to the periphery are slower than those toward the center.

30-5

Lion, Kurt S., and Brockhurst, Robert J.: *Study of ocular movements under stress,* Arch. Ophth., 46:315-318 (Sept.) 1951.

The article tells how the eye is put to stress by watching, alternately, two flashing lights 90 degrees apart. The test is halted when the subject can go on no longer. This test measures by the electronic method the acceleration of the eyeball, which is proportional to the muscular force which causes the eye movement.

33-1

Hewitt, Robert S.: *Innervational factors concerning the vertically acting extraocular muscles,* Am. J. Ophth., 34:597-604 (April) 1951.

In this paper a principle has been presented as to how the vertically acting muscles function for any ocular movement or position of the globe and some experimental evidence to support the validity of such a principle.

This principle provides (1) for a constant ratio of innervation between the superior rectus and the inferior oblique muscles; (2) for a constant ratio of innervation between the inferior rectus and the superior oblique muscles (with a normally functioning neuromuscular mechanism both of these ratios are approximately 2:1); (3) for true antagonists among the vertically acting muscles; (4) for the principle of reciprocal innervation to function with regard to the vertically acting muscles. It presents an explanation for a straight up or down movement from the primary position without additional action by the lateral rectus muscle, as well as an explanation for the torsion that occurs when the eye is in an oblique position.

It is the author's belief that the application of this principle will be found helpful in the understanding and management of vertical muscle imbalance.

33-2

Urist, Martin J.: *Horizontal squint with secondary vertical deviations,* Arch. Ophth., 46:245-267 (Sept.) 1951.

Dissociation of normal eyes for any period of time reveals vertical deviations are just as prevalent as lateral deviations. In a series of 615 patients with horizontal strabismus whose deviations were measured by prism and cover test, 431 or 79 per cent showed a vertical component.

A careful study of the versional movements was made. Changes were noticed in the horizontal angle of squint in certain cases of esotropias and exotropias as the patient followed the light straight up and down. The term "elevation or depression in adduction" was used to describe this condition.

In the study of the versional movement with a quantitative study of these movements with prism and cover in all positions of gaze it was found that the combination of horizontal with a vertical component was found quite frequently.

The study led to the following classification:

1. Esotropia with bilateral elevation in adduction.
   a. Marked elevation of the adducted eye on lateral movement to the right or left.
   b. On versions in the vertical direction there was found more esotropia when looking down than up.
   c. More esotropia for near than distance.
   d. Good near point of convergence.
   e. Left hypertropia greatest looking up and to the right and a right hypertropia greatest up and to the left.
2. Esotropia with bilateral depression in adduction.
   a. Depression of the adducted eye on lateral movement to the right or left.
   b. More esotropia for distance than for near.
   c. More esotropia when looking up than on looking down.
   d. Elevation of right eye on gaze to the right and elevation of left eye on gaze to the left.
   e. Near point of convergence varies from good to fair.
3. Exotropia with bilateral elevation in adduction.
   a. Elevation of the adducted eye on lateral movement to the right or to the left.
   b. Exotropia was greater for distance than for near.
   c. Exotropia looking up and a smaller exotropia on looking down.
   d. Patients screened a left hypertropia on gaze to the right, greatest up and a right hypertropia on gaze to the left, greatest up.
   e. Near point of convergence good.
4. Exotropia with bilateral depression in adduction.
   a. Depression of adducted eye (relative elevation of the abducted eye) on lateral movements.
   b. Larger exotropia for near than for distance.
   c. Exotropia greater on looking down rather than up.
   d. Patients screened a right hypertropia on looking to the right and a left hypertropia on looking to the left.
   e. Near point of convergence is usually poor.

The study of the straight up and straight down position also gives one an idea of the binocular status of the eyes. If the eyes are straight in one of these positions, fusional amplitudes could be developed. Orthoptic exercises are started in the position where the eyes are straight.

The evidence that vertical deviations are secondary to the lateral squint are based on: (1) patients with secondary deviations do not have torticollis and are able to fuse large vertical deviations, this would be rare in a case of primary vertical paralysis, (2) patients can have straight eyes yet when the eyes are dissociated, they have horizontal deviations with large vertical components, (3) the cases studied all showed a smaller vertical measurement than those of the horizontal squint and (4) correct surgery on the lateral muscles helps to improve the vertical deviation.

If the lateral squint is taken care of by glasses, orthoptics or surgery, one will find that the vertical deviation will be much improved or will disappear completely.

34-1

Low, Frank: *Peripheral visual acuity*, Arch. Ophth., 45:80-99 (Jan.) 1951.

It is recognized that no single investigation has ever controlled all the factors known to affect peripheral visual acuity. After further study in this field, Dr. Low concludes that all available evidence indicates that the characteristics of peripheral visual acuity have a counterpart in central acuity. Such factors as (1) effect of angular eccentricity, (2) effect of differences in meridional acuity, (3) effect of test object differences, (4) effect of brightness, (5) magnitude of individual differences, (6) effect of practice, (7) effect of spontaneous fluctuation, (8) effect of refractive conditions, (9) effect of color, (10) effect of limitation of viewing time, (11) effect of movement, (12) effect of psychological factors, and (13) effect of other factors, though especially pertinent to central acuity, nevertheless bear the same essential relationship to each other and to acuity itself in the periphery. It appears that the differences between peripheral visual acuity and central visual acuity are quantitative, rather than qualitative.

34-2

Raiford, Morgan B.: *Aids for determining visual acuity*, Am. J. Ophth., 34:892-893 (June) 1951.

A variation of the "E" game and a description of a new type stick pointer are presented.

34-3

Sloan, Louise L.: *Measurement of visual acuity: A critical review,* Arch. Ophth., 45:704-725 (June) 1951.

Dr. Sloan has investigated the relative merits of different test objects and procedures used to measure visual acuity and their use as screening tests for the detection of errors of refraction or other visual defects.

The tests of acuity used by ophthalmologists, optometrists, and in the military services are designed to detect impairment of acuity caused in a large number of cases by errors of refraction. By using the simpler test objects, patients with astigmatic errors may show a better visual acuity. For example, a patient with a simple hypermetropic astigmatism at axis 180 degrees can focus vertical and horizontal contours and, therefore, may have no difficulty with the Snellen E. The ideal test object should contain horizontal, vertical, oblique and curved contours so that it can be recognized only when clearly focused in all meridians.

The test characters should be of "a complicated form as is clinically convenient in order to subject the eye to a test comparable with varied tasks imposed upon it in every day life and yet the questions and answers should be simple enough."

"It is suggested that familiar nonserif letters be used to measure visual acuity and that about 10 such letters be selected which by experiment are found not to differ markedly in legibility. If this same group of letters is used on each line of the acuity chart, the average difficulty of each line as a whole will vary only with the size of its letters."

In the measurement of individual differences in acuity, some standard luminance of background must be adopted. The standard adopted should approximate that encountered in the use of the eyes under ordinary conditions. If the contrast is at least 84 per cent and if the background luminance is between 12 to 18 footlamberts, variations in contrast and in luminance of background will have a negligible effect on acuity.

Visual acuity measured at 6 meters provides a valid index of acuity at all greater distances. In special cases measurement of visual acuity may be taken nearer representative of typical working conditions.

The visual acuity of each eye should be determined with occlusion of the other eye. In many cases visual acuity is higher with occlusion than without. Since the two eyes cannot accommodate unequally, in binocular vision the amount of accommodation will probably be that required by the dominant eye if the hypermetropia is greater in one eye.

In cases where a patient's occupation requires a high degree of binocular depth perception supplementary tests of depth perception may be used to evaluate the efficiency of binocular vision. In such cases the refractive correction of the two eyes should be balanced.

28-2

Fink, Walter H.: *Surgery of the oblique muscles of the eye,* St. Louis, C. V. Mosby Co., 1951, as reviewed in Arch. Ophth., 46:713-714 (Dec.) 1951.

This volume about the surgery of the oblique muscles is divided into two parts. The first part deals with anatomy only and is fully illustrated. It gives the reader a clear picture of the intricacies of the relationships of these muscles and the structures to be encountered when operating. The second part deals with the physiology of the muscles and the diagnosis of the defects.

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